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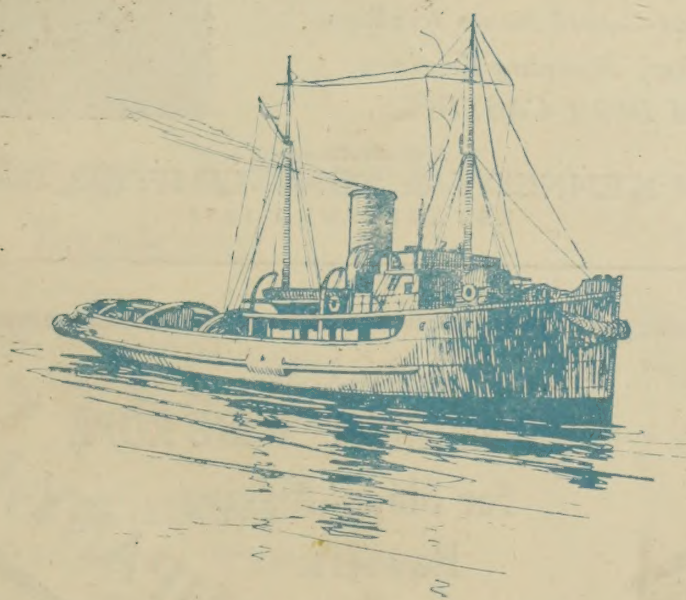

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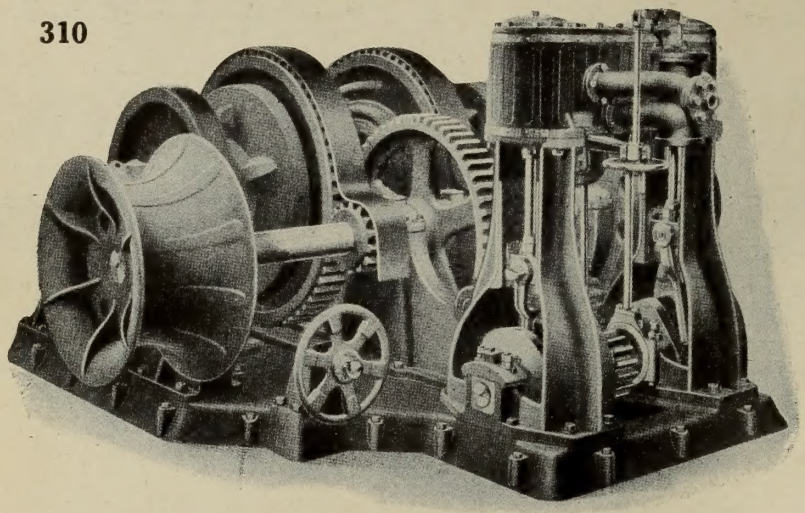

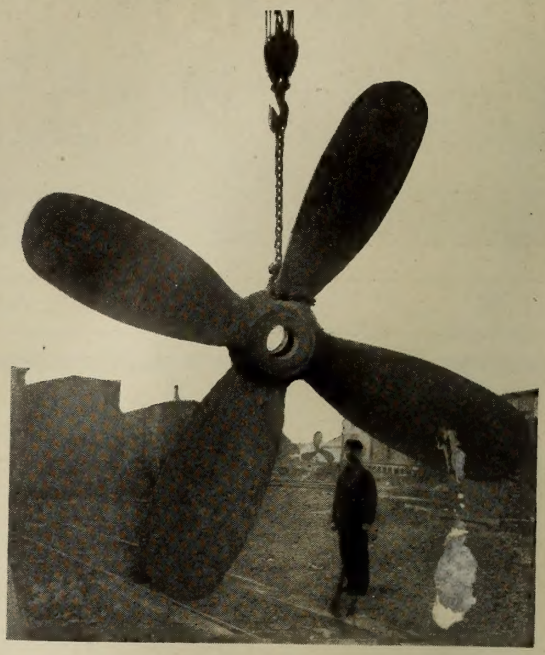

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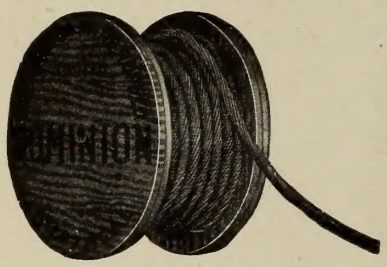

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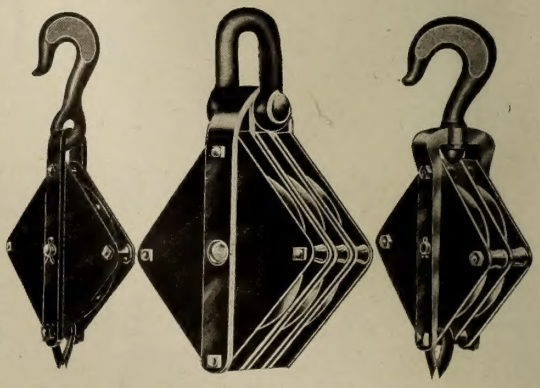

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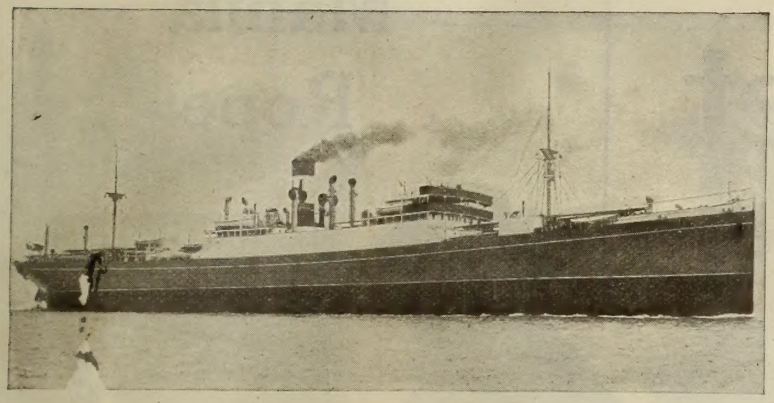

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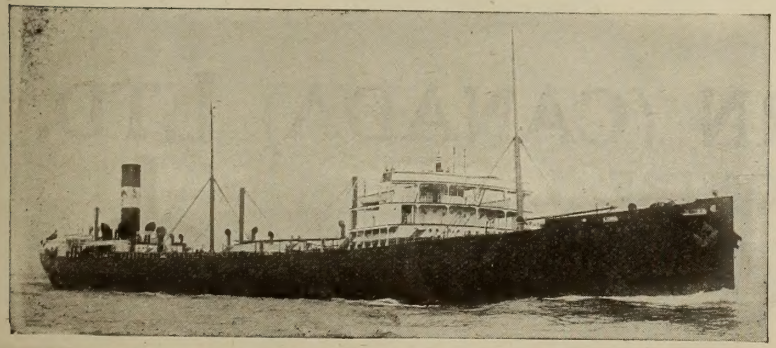

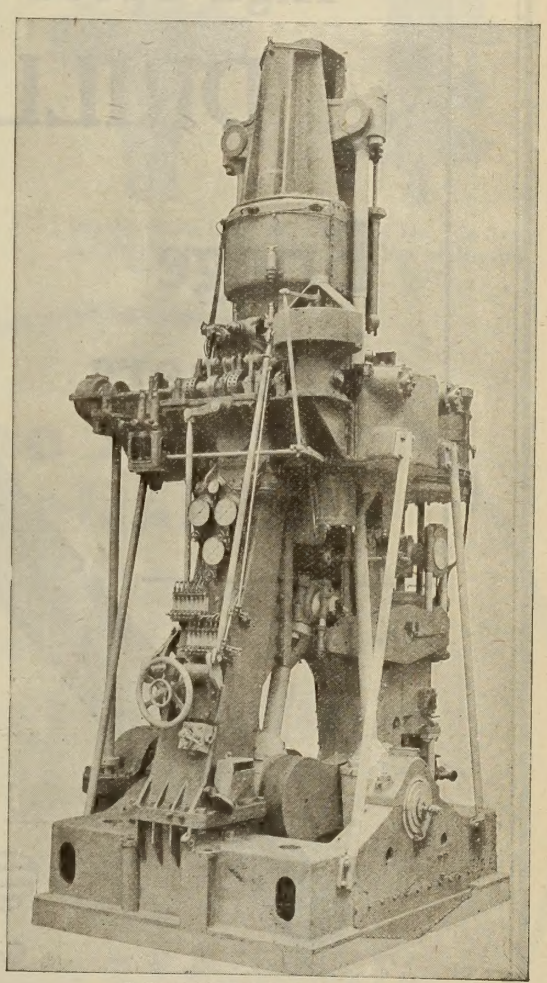

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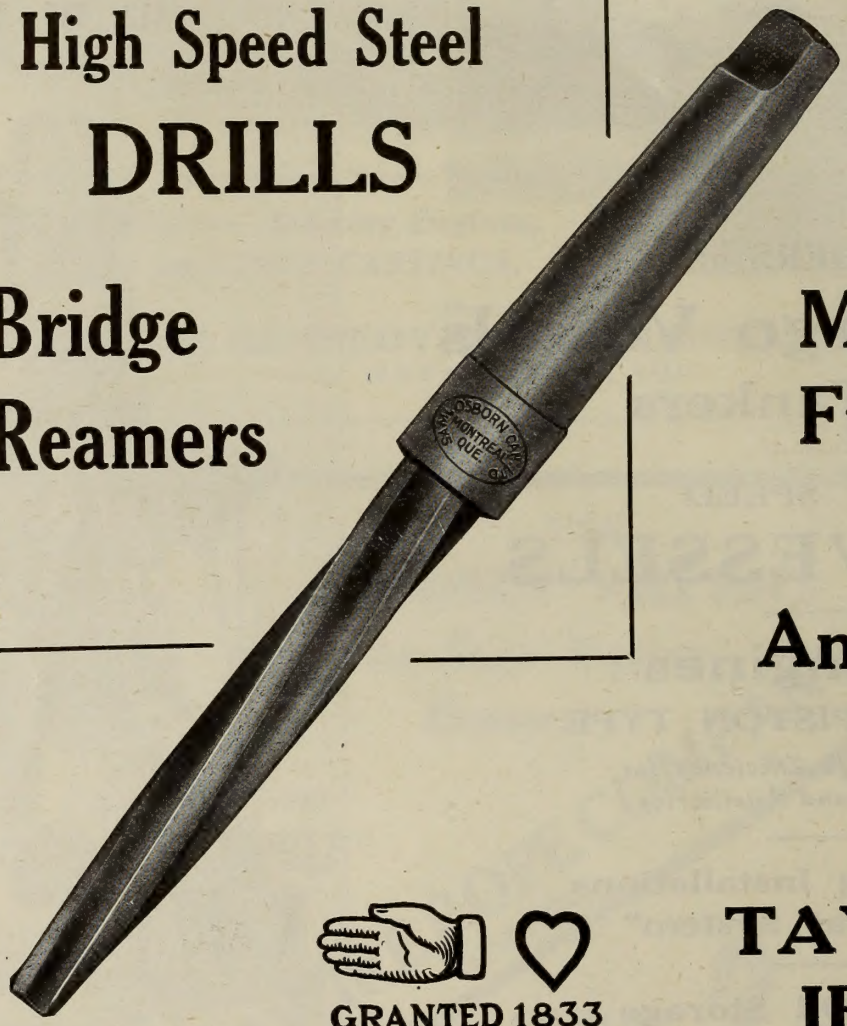

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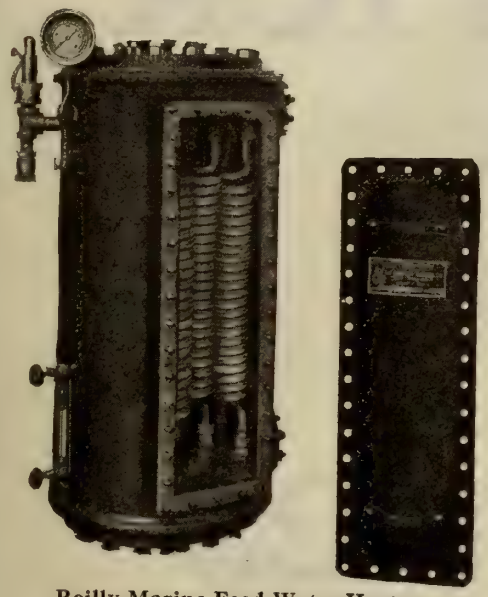

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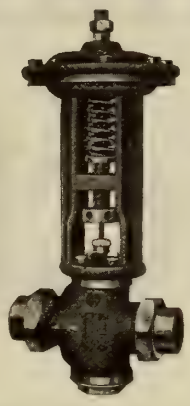

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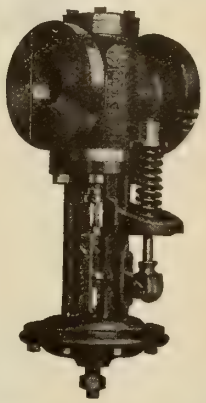

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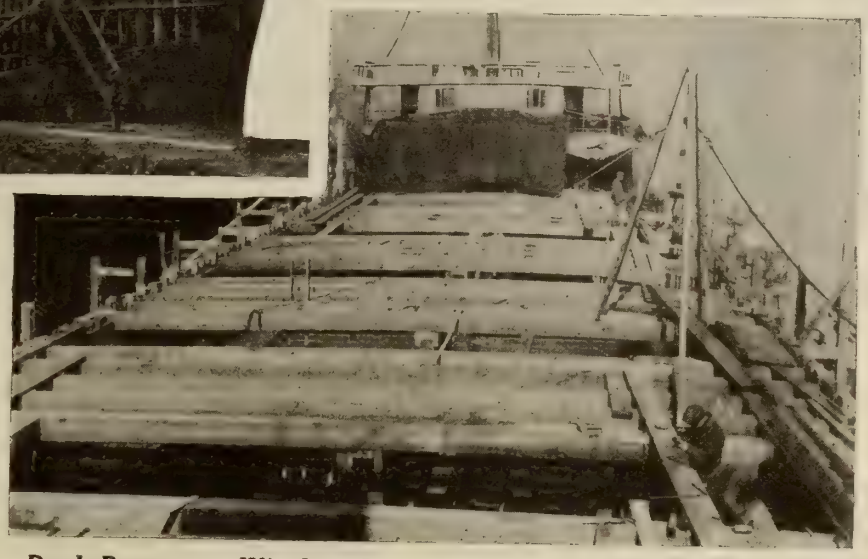

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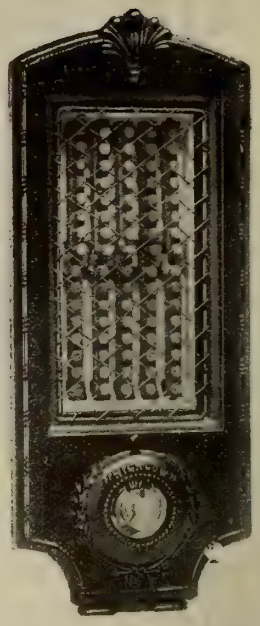

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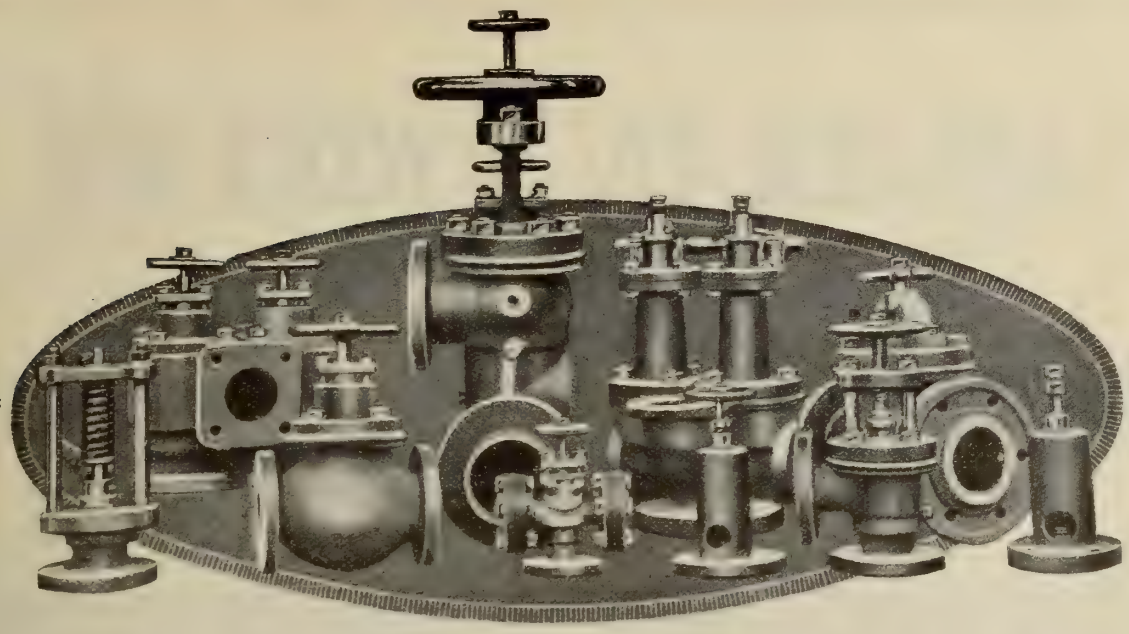

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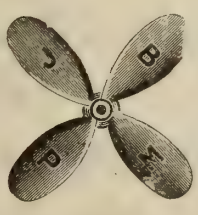

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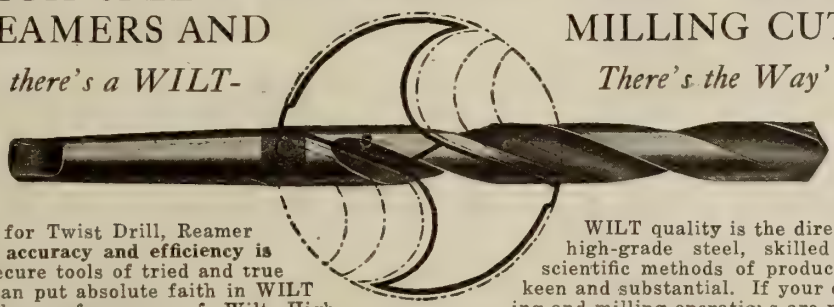

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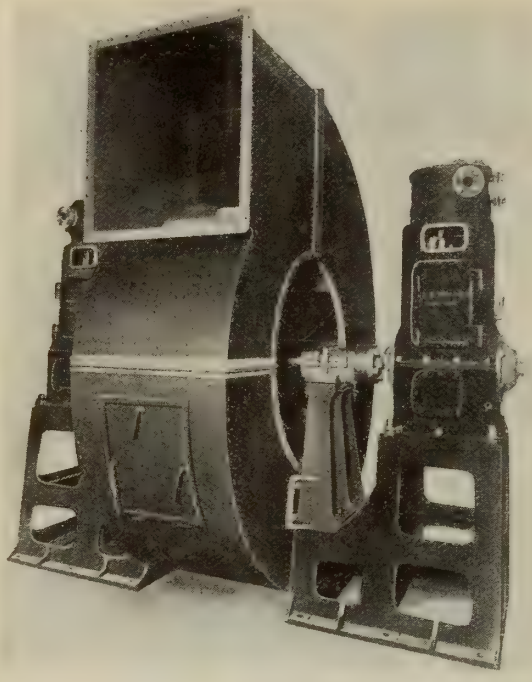

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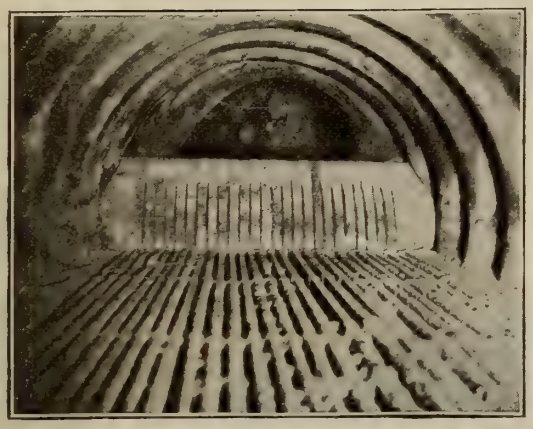

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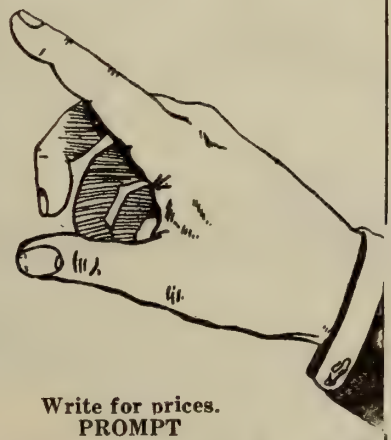

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For sharpening all kinds of wood-worker's tools this grinder is without an equal. Being fitted with a large driving pulley and having an ample water supply, it produces the finest edge in but a fraction of the time taken by a grindstone or dry wheel. It takes up less room, is cleaner, more accurate than a grindstone and does not draw the temper like a dry emery wheel, and is the cheapest tool grinder yet produced having these advantages. The machine can be set up anywhere and takes bench room of 22″ x 18″ only, allowing several to be set up in large shops being distributed just where required. The saving thus obtained, by keeping the men close to their work, and the better condition of tools, soon repays the small cost.

Manufactured by

The Ford-Smith Machine Co., Limited
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Port Arthur Shipbuilding Company, Ltd.

PORT ARTHUR, ONTARIO, CANADA

Designers and Builders

Steel Ships, Engines, Boilers, Etc.

Noronic

Leaving plant of Port Arthur Shipbuilding Company, Ltd., on completion, May, 1914.

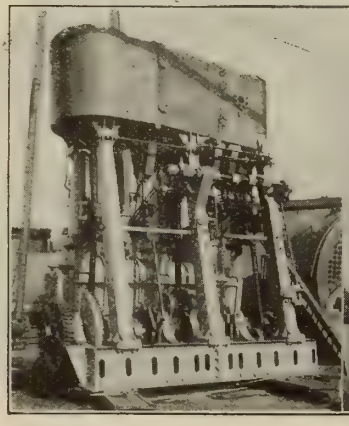
Passenger and Freight Steamer

Length Overall 385 ft.

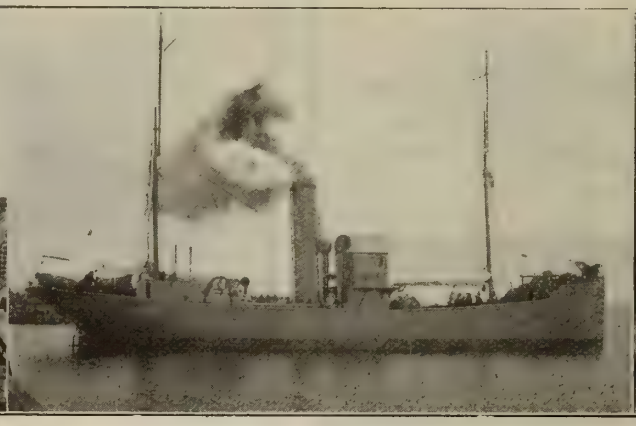
Breadth Moulded 52 ft.

Depth Moulded 28 ft. 9 in.

Gross Tons 6,905



1500 H.P. Engine, Triple Expansion



Fourteen of these Trawlers for Dept. of Naval Service

Wheel Casting 14 ft. 9 in. diameter

The above are some of the products of our plant
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DRY DOCK 700′ x 93′ x 16′
Four Building Berths

General Offices and Plant:
PORT ARTHUR, ONTARIO

MARINE ENGINEERING
and
Canadian Merchant Service Guild Review

Vol. X. TORONTO, JANUARY, 1920 Number 1

An Ocean-Going Tug of Reinforced Concrete

The Description of This Tug, Which is One of Several of the Same Type, is Taken From the "Engineer" and Presents Some Interesting Features

THE second of a series of six tugs under construction at the shipyard of John verMehr, Shoreham-by-Sea, Sussex, to the order of the Ministry of Shipping, was launched successfully on September 13, 1919. In general arrangement the tug, as seen in the drawing below, is somewhat similar to those under construction by a number of firms throughout the country. The design and construction of the reinforced concrete hull, however, probably present some features of particular interest, and the following description will be mainly confined thereto.

The principal dimensions of the vessel are:

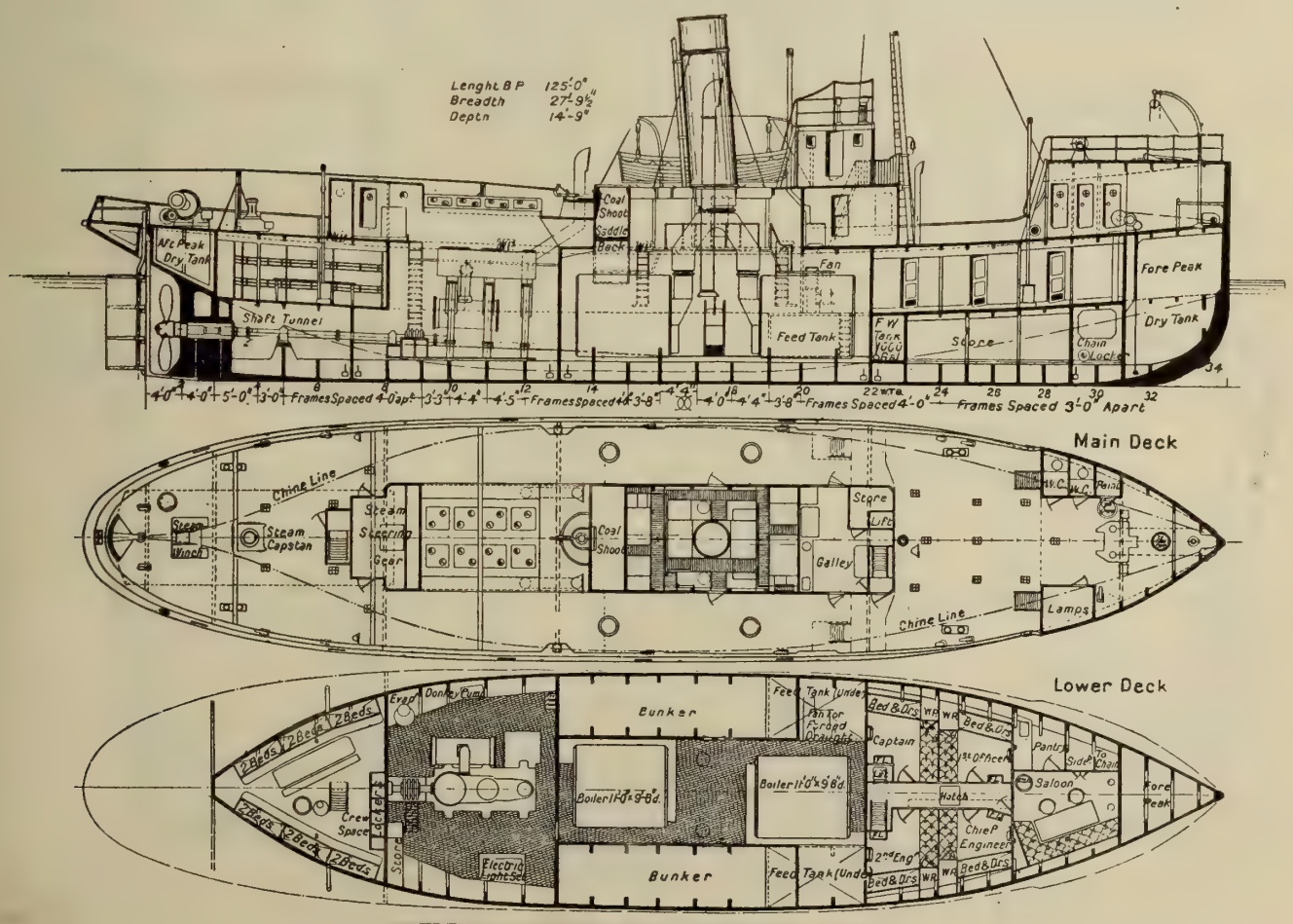
Length	125 ft.
Breadth	27 ft. 9 in.
Depth moulded	14 ft. 9 in.
Displacement to 12 ft. water line	685 tons

These tugs are intended for sea-going service, and have triple-expansion engines of 750 horsepower and two Scotch marine boilers 11 ft. long by 9 ft. 6 in. diameter, 180 lb. working pressure and fitted with Howden's forced draught system. The bunker capacity is about 80 tons.

The forecastle deck forward was originally intended to support a gun, and is now utilized for stowing anchors. Officers' accommodation is provided under the main deck forward, and the crew is housed under the main deck abaft the engine-room, provision being made for a total complement of seventeen men. Two towing hooks with guide rings, etc., are fitted abaft the boiler casing, and the deck machinery comprises an automatic towing winch aft, a capstan aft for warping purposes, and an anchor windlass with warping drums forward.

The whole of the hull, apart from minor details, is constructed of rein-

REINFORCED CONCRETE TUG



ELEVATION, DECK AND UNDERDECK PLAN

forced concrete, with the exception of the engine skylights and boiler casing top, which are of steel, and the chart house and part of the boat deck, which are of wood. The reniforcement consists principally of round mild steel rods, but part of the mesh work in the 'tween decks and bulkheads is expanded metal.

Conditions of Design of Hull

(A) The working stresses adopted on the materials are as follows:

	Lbs. per sq. in.
Tensile stress on steel generally	16,000
Tensile in skin slabs and outer corners of frames	15,000
Tensile stress on steel in bulkheads	17,000
Compressive stress on concrete generally	725
Shearing stress on concrete alone	60
Compressive stress on concrete in bulkheads	900
Tensile stress on steel shear members	12,000

(B) The loading conditions governing the principal longitudinal bending and shearing stresses are as follows:

(a) Hogging condition. Vessel complete and fully equipped, but carrying no coal and no reserve feed-water. Peak tanks empty. Vessel on standard wave with crest amidships.
(b) Sagging condition. Vessel complete with all coal stores and reserve feed-water on board; peak tanks empty. Vessel on standard wave with trough amidships.

(C) The conditions governing the transverse bending and shearing stresses on the frames are as follows:

(a) Vessels full equipped resting in dry dock on a single line of blocks. Bunkers empty.
(b) Vessel at maximum draught and immersed to upper deck level, account being taken of weight of structure and internal loads.
(c) Vessel at minimum draught and in trough of wave, account being taken of weight of structure and internal loads.

The decks are designed for a superimposed load of 224 lb. per square foot. Water-tight bulkheads are designed for a pressure of water extending up to the deck level. Feed and fresh-water tanks are designed on the assumption that they may be filled from the upper deck.

Design of Skin, Frames, etc.

The skin slabs were treated as continuous slabs supported by the frames and subject to the load due to a head of water up to the level of the deck. The water pressure being practically uniform over continuous frame spaces, the bending moment at the supports was taken as W L/12, and in the centre of spaces as W L/24. In addition to acting as slabs under bending, the botton skin and the deck require to withstand longitudinal stresses of tension and compression under hogging and sagging conditions, whilst the side skins of the vessel have to withstand considerable shearing stresses under these conditions.

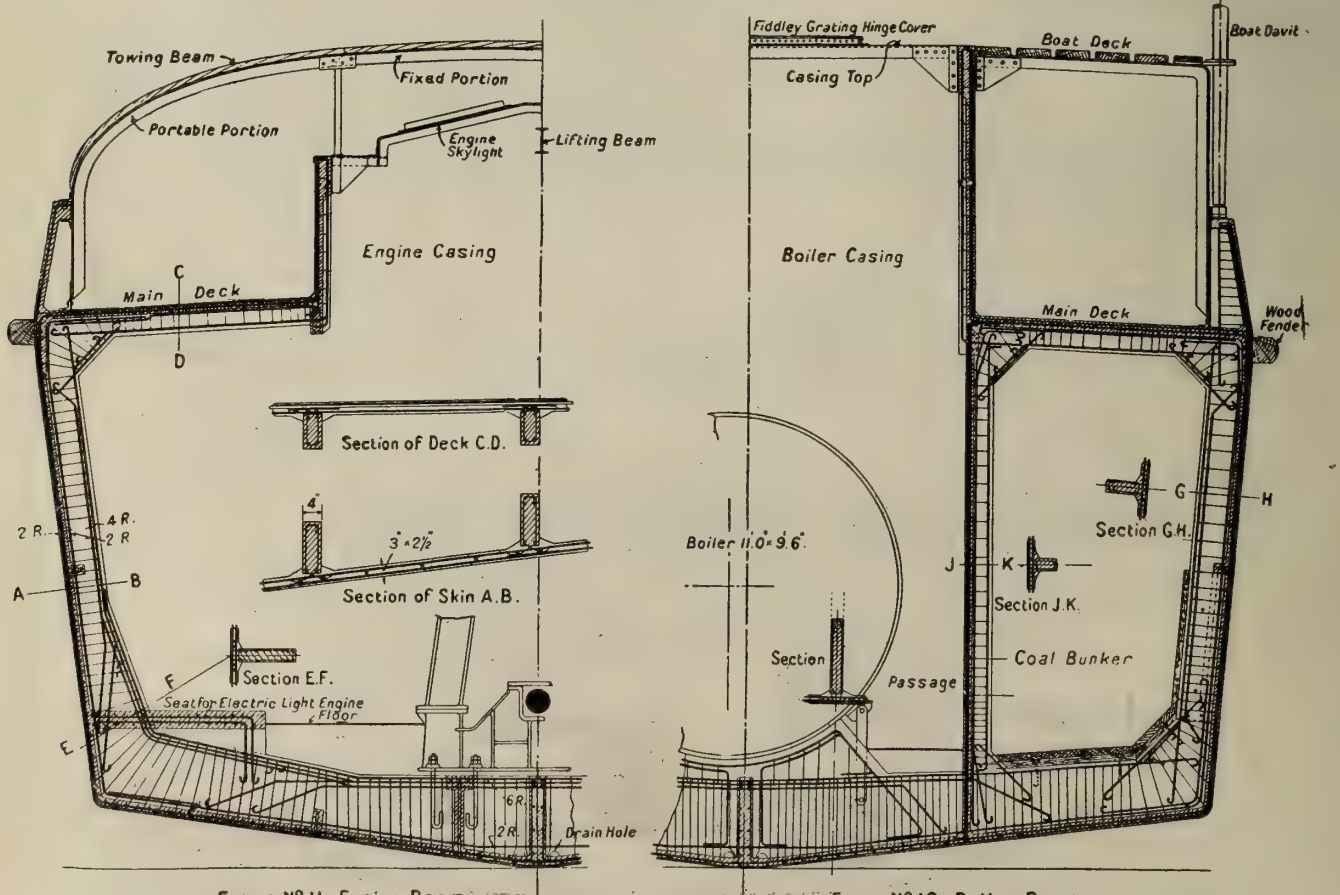
Adequately to resist the bending stresses in the slab, a mesh work of reinforcement is provided close to each face of the slab, and in the bottom and deck a separate layer of longitudinal steel resists the principal longitudinal stresses, whilst another intermediate system of reinforcement deals with shearing stresses in the sides, bottom, and deck.

The frames, of which typical examples are shown on Figs. 6 and 7, were designed as complete stiff members, including the deck beams and pillars where they occur. Generally they contain a group of rods on the inner face and two rods only in the outer face of the precast portion, the remaining metal in this flange being made up by additional rods provided in the skin—see Section A B, Fig. 6. Considerable compression reinforcement is provided in order to reduce the dimensions and weight of the frames, and the sections are everywhere capable of taking reverse stresses.

Generally the longitudinal steel in the bottom and in the deck is well distributed, and large concentrations of heavy metal are entirely avoided. Immediately underneath the deck there is a thickening of the side skin arranged to take a number of heavier longitudinal rods and at the same time form a substantial fixing for the timber belting which encircles the vessel at this level. A longitudinal stringer, which also runs under the deck at each side of the engine and boiler-room openings, is continued past these openings to the peak bulkheads, and contains a number of substantial longitudinal rods. In the deck itself additional transverse reinforcement is provided to act as an effective cross-tie at the ends of the above-mentioned openings. This additional reinforcement is provided as a precaution against cracking of the concrete at the corners of the openings where a sudden change in the area of the cross section of the deck occurs.

System of Construction

The system of construction adopted consisted in precasting the frames complete in groups of six in the horizontal position and then erecting them on the ways like the frames of a steel ship. These frames formed a skeleton of the vessel, which was then covered with a



CROSS SECTION AT FRAMES 11 AND 16.

fabric of reinforcing rods and expanded metal as the basis for the construction of the skin, deck, bulkheads, etc. After this meshwork was completely fixed and wired together, the outer shuttering for the skin was brought into position in large shop-repaired panels, moulded to the shape of the hull. The inner skin shuttering, formed of loose boards held up against timber fillets bolted to the precast frames, was put in position in courses as the concreting proceeded.

Construction of Frames

There is practically no parallel body in the vessel and no two frames are alike. Templates for each frame were taken from the full-sized "lay-off" on the scrieve board. The outlines of the frames were marked off from the templates on a prepared concrete casing platform, and arrangements were made for setting up shuttering to these outlines. Reinforcement for the precast frames was made, wired together to template, and built into a complete unit which could be handled. The first unit of each set was placed on the concrete casting platform and shuttered around the edges, the ends of the bond stirrups being allowed to project through the timber. During concreting the reinforcement was kept alive under the vibration of a light pneumatic hammer with a flat head, which was effective in getting a thorough filling of the moulds and a dense watertight concrete. A layer of greased paper was laid on the concrete surface when set, and on it the next frame unit was supported, shuttered on the edges, and concreted. This procedure of casting frame after frame on top of each other was continued until each set of six similar frames, one for each of the six tugs, was completed. The method is economical of shuttering, and enabled a considerable amount of intricate work to be carried out under satisfactory conditions in a yard apart from the actual building berths, and even in advance of their construction.

Erection of Frames

The frames were easily parted from each other by wedging in between small sheet iron plates cast in at the edges. Lifting was done by means of a stiff timber cradle bolted to the frames at a number of points so as to reduce bending stresses in handling, and a 5-ton travelling crane transported and set the frames in position on the berth. Erection of the frames was begun at the stern and was worked forward, the frames being set normal to the berth, and the tendency to tilt it being counteracted by longitudinal rakers at the stern and distance pieces between the frames at the deck. The frames were stayed laterally by side rakers. The track for the travelling crane was laid down the centre of the berth and lifted as the erection of the frames proceeded.

Fixing of Reinforcement

The principal longitudinal member in the bottom of the vessel is the centre keelson, which carries a number of heavy longitudinal rods. Open spaces were arranged through the middle of the frames to take these rods and at the same time provide a thorough bond for the concrete. The rods were passed through the openings as the erection of the frames proceeded, and long laps were provided at the joinings of the rods in the spaces between the frames. The longitudinal rods in the side keelsons and side stringers were similarly strung through holes previously left in the frames.

The skin reinforcement is shown in Section A B, Fig. 6, and consists of:

(1) An inner layer of longitudinal rods to take the slab bending stresses.

(2) An intermediate system of transverse rods, some of which make up the outer flanges of the frames and part act as additional shear reinforcement in the skin.

(3) The outer layer of expanded metal, which resists bending stresses in the slab and at the same time provides a close mesh of reinforcement continuous in every direction.

In the bottom skin and in the side strips of the deck there is provided:

(4) An additional system of longitudinal rods to assist in resisting the principal longitudinal stresses.

The longitudinal rods in Layer No. 1 are placed along the outside of the precast frames passing between the projecting points of the bond stirrups. The transverse rods in Layer No. 2 are then fixed and wired to the preceding system. Next the outstanding stirrup ends on each frame are bent over the frame bars so as to furnish effective connection between the precast frames and the situ cast skin. The outer layer (No. 3) of expanded metal is then wrapped around the vessel in large sheets, and the whole mesh work is well wired together. The details of this construction are clearly shown on Section A B, Fig. 6. The mat of meshwork so formed is very stiff, and gives hardly any deflection under the weight of a man.

With a stiff skeleton to work on, such as is provided by the precast frames, the erection of the skin reinforcement can be easily and rapidly carried out. Both sides of the meshwork are accessible to the workmen, and there is no difficulty in fixing the steel work and tying it up together, such as occurs when the work is done close to an outside mould, as in complete monolithic construction. There is a further advantage that the metal can be cleaned immediately before the erection of the shuttering, while the concreting can be begun immediately thereafter, avoiding the warping of boards and opening of joints which occurs when the timber is exposed to the weather for long periods. When the skin reinforcement is complete, the outer shuttering, which has been previously made up in large panels, moulded to the exact shape of the outer surface, as taken from the full-sized lines, is placed and supported in position, being kept at the required distance from the reinforcement by means of concrete spacers. No interior shuttering is required for the bottom, except for the short distance at bow and stern where the angle is steep. On the sides of the vessel the interior shuttering consists of loose boards fitted in the frame spaces and held against wooden fillets bolted to the frames. These boards were set in position in horizontal courses as the concreting of the sides was brought up.

The shuttering for the decks is supported on fillets bolted to the deck beams, and was fixed before the deck steel work was placed.

Mixing and Placing Concrete

The concrete used in the construction of the vessels was gauged 1, 1 1/3, 2/3, the aggregate consisting of gravel and sand drawn from the beach at Shoreham and passed through a ⅜ in. screen. The results attained under crushing test average 2,250 lb. per square inch at seven days and 3,500 lb. at twenty-eight days, the requirements of the Ministry of Shipping being 1,600 lb. and 3,200 lb. respectively. The concrete was machine-mixed in Ransome mixers, and as it was being poured into place between the shuttering, pneumatic hammers kept the reinforcement vibrating. The outside of the shuttering was also vibrated, the result being a very dense water-tight concrete, thoroughly worked all round the reinforcement.

ACCURACY OF RADIO BEARINGS

The following information was furnished by the Director of the U. S. Naval Communication Service under date of October 10, 1919:

"The reliance that can be placed in bearings furnished by shore radio compass stations will be governed by the following conditions:

"(a) When two sets of bearings are received which do not agree, a third set should immediately be requested.

"(b) In thick weather bearings should be requested at least every half hour.

"(c) Bearings that pass over intervening land or that are tangent to the shore line are not as reliable as those that have a clear sweep over the sea.

"(d) Navigators receiving a set of bearings should immediately investigate the approximate fix indicated and determine whether or not they are being furnished with bearings from the stations that should be most reliable.

"(e) When the position of the ship as indicated by the radio bearings differs materially from the position by dead-reckoning, a second set of radio bearings should be requested in order to check the first radio position."

The Status of the World's Mercantile Fleet

by
T. H. Fenner
Editor "Marine Engineering"

WITH more tonnage under construction than at any previous time, the centre of gravity of the world's merchant fleets shows a considerable movement from pre-war days. The chief cause of this is, of course, the heavy losses sustained by Great Britain, and the heavy gains made in the United States. Other nations have also come into the field, but the distribution of tonnage between the two great Anglo-Saxon nations is the dominating feature of the situation.

If we look at the relative positions at the outbreak of war, and that of the present day, we will see what a radical change has taken place. The question that is uppermost in the minds of those interested in shipbuilding on both sides of the Atlantic is "How will we stand two years hence?" The latest available figures show that Great Britain, emerging from her sacrificial labors of the war, and her more recent labor difficulties at home, is beginning to catch up. On the other hand, construction in the United States is declining. The general losses in the world's fleet are being made up, and ere very long ocean freights will be governed by normal competitive rules. The day when anything capable of carrying a cargo can be operated at a profit will be past, and the vessel that can keep out of dock for the longest time, and take the least amount of maintenance and operating cost will be the survivor. Again, if two competing vessels are on an equality as regards these prime essentials, the prize will go to that one which enjoys the greatest skill in management. In that day years of successful experience in ship operation will be a big factor against competition from comparative newcomers, however brilliant they may be. But those days are yet in the future, and in the lap of the gods. Let us turn to concrete facts and see where the nations stand.

The Tonnage in 1914

IN August, 1914, the tonnage of the world's fleet was approximately 40,000,000 tons gross. This is equal to about 60,000,000 tons deadweight carrying capacity. Of this, Great Britain possessed approximately 20,000,000 tons, or about one-half the total tonnage of the world. The United States at the same date had 2,700,000 gross tons of ocean-going shipping. France possessed 2,325,000 gross tons, Italy about 1,700,000, Japan about the same, Swden, 1,222,000; Norway, 2,500,000; Denmark, 737,500. Spain had 864,395 tons, Greece about the same, Holland, 1,500,000; Belgium, 400,000, and Brazil, 3,000,000 gross tons. Of the enemy nations' fleets, Germany owned by far the largest. Her fleet was ,in fact, second only to that of Great Britain. She had a total of 5,291,000 gross tons, while Austria had only 1,000,000.

During the war the losses to the allied and neutral nations amounted to about 15,000,000 tons. Here, again, Great Britain was by far the largest loser. This was, of course, inevitable. Her ships kept the seas and carried her troops and supplies from every corner of the world, besides carrying supplies to other nations. Her total losses were 9,000,000 tons, or about 45% of her fleet as it was in August, 1914. During the war, in spite of her enormous production of naval vessels, and repairs to damaged ships, she built 4,342,000 tons. Captured vessels and ships bought from other countries amounted to 1,247,000 tons, a total of 5,589,000 tons. Her net losses were, therefore, 3,443,000 tons. This left her at the end of the war with a tonnage of 15,814,000. Her losses were in some respects greater than appears on the surface. This is because she lost a large number of her first-class passenger liners, which are hard to replace, as well as the larger size of cargo carriers, which carried on trade as regular liners on established routes. Now she is getting down to cases, and her yards are busy on the production of both cargo and passenger ships, the naval construction having been dropped. The comparative construction figures further on in this article will show just what is being done in this direction.

The Position of United States

THE record of the United States shipping during the war is, of course, one of pure gain. By new construction alone she added to her fleet 875 vessels of 2,941,845 tons. In addition to this she purchased 233 vessels of 833,854 gross tons, and brought down from the lakes 66 steamers of 140,000 gross tons. Her losses by enemy action amounted to only 322,214 gross tons, and this was offset by the seizure of 81 enemy steamers of 546,000 tons. The U. S. shipping profit and loss account shows a good credit balance

A MODERN OIL TANKER—ISHERWOOD CONSTRUCTION.

through the war. Her sea-going merchant marine of 2,706,317 gross tons in 1914 had grown at the end of the war to 5,515,180 gross tons. Including lake and coastwise shipping, she has 12,000,000 tons.

France lost about 40% of her pre-war shipping and has no new construction in her own country to take its place. She is getting some ships built in Canada at present, and a large number of wooden steamers were built here during the war. These vessels were of 1,500 to 3,500 tons deadweight, and their value to France is, with all due deference, problematical. France demanded that the enemy merchant ships seized at surrender should be turned over to her in the proportion of ton for ton, and that she be allowed to buy 1,000,000 tons each from Great Britain and the United States. These plans have not yet been realized, but it shows her ambition to become a maritime nation. This ambition is shared by others.

Italy, who lost about 51% of her merchant fleet during the war, is also taking steps to rehabilitate herself, and a bit more. She has now about 36 shipyards in operation, and still more are planned. She hopes to obtain an annual output of 400,000 tons, if she can obtain the raw material. This has in the past been obtained chiefly from Great Britain, and during the war that source was, of course, shut off. She is looking now to develop her own resources, chiefly on the island of Elba.

Japan was another nation that came out of the war exceedingly well as far as her ships and shipbuilding capacity are concerned. She lost through enemy action only 132,000 gross tons. She sold to other countries about another 125,000 and purchased 130,000 tons. During the war she built for herself 768,325 gross tons, the net result of her activities being an increase of 25% on her pre-war fleet. She also built for the U.S. about 130,000 tons, and had under construction at the end of the war about thirty more steamers for the U.S. Japan has expanded her shipbuilding facilities enormously, and has now an annual capacity of over 1,000,000 tons. However, despite the low cost of labor, the difficulties of securing plates, etc., have resulted in Japanese costs going up till they are in the neighborhood of $185 per ton.

The Scandinavian nations also suffered during the war, and their efforts at new construction were hampered by the lack of raw materials. Norway was the heaviest neutral sufferer among the nations. Out of a tonnage of roughly 2,500,000 she lost no less than 1,178,000 gross tons. To counteract this, she had under construction at the end of 1918 about 200,000 tons. This was made up of steamers and motor ships, fifty of which were of wooden construction and eight of concrete. It is interesting to note that the Norwegians were among the first to undertake the construction of concrete vessels, and they adopted methods which have been widely copied by other builders. Sweden lost about 18% of her merchant fleet by enemy action, amounting to 202,000 tons. She had under construction at the end of last year about 60,000 tons. The Swedish yards are very busy, but have suffered from the difficulty of obtaining ship plate, which were in pre-war days imported from England. Denmark also suffered from the submarine activities, her losses being 219,000 gross tons out of 739,532, leaving her in June, 1918, with 600,000 tons. The difference was made up by new construction which amounted to 100,000 tons, and sale to and purchase from other nations about equalized themselves. Spain had a merchant navy of approximately 864,000 tons before the war. She came out of it with about 650,000 tons. She lost by enemy action 166,000 tons, while marine risks and sales accounted for 133,000 tons. New construction amounted to 35,000 tons and purchases 47,000 tons. Greece, Holland, Belgium and Brazil all suffered heavy losses, the totals being 662,000 tons out of a tonnage of 2,900,000 tons belonging to the four nations.

H.M.S. "WITHERINGTON," 28,000 H.P. GEARED TURBINE.

H.M.S. "RENOWN," 100,000 H.P. GEARED TURBINE

What Canada is Doing

THE total tonnage under construction in the Dominion of Canada in June, 1914, was 14,184 tons gross. In 1915 the necessity for more ships had become apparent

and the Imperial Munitions Board took up the question of building ships in Canada. Contracts were given out amounting to $70,000,000, including both steel and wooden ships. There were 43 steel and 58 wooden ships. This started shipbuilding in Canada in good earnest, and it has kept up so far in very good shape. At the end of 1918 there were 45 berths for steel vessels ranging from 3,500 to 10,500 tons in the various yards. The Canadian Government Merchant Marine programme came along when the I.M.B. ships were being finished, and is still keeping the majority of the yards going.

In addition to this, some firms built ships to their own account, for sale, and at least one firm is doing so at present. Other yards have contracts for European tons, were being built. The great preponderance of tonnage compared with the slight difference in numbers building, is accounted for by the larger size of the vessels built in the deep-water yards. These vessels are all steel. Besides these, 49 wooden ships of approximately 49,000 tons were under construction. All the other British Dominions had between them only 24 steel vessels of 77,000 tons, and 9 wooden vessels of 6,443 tons.

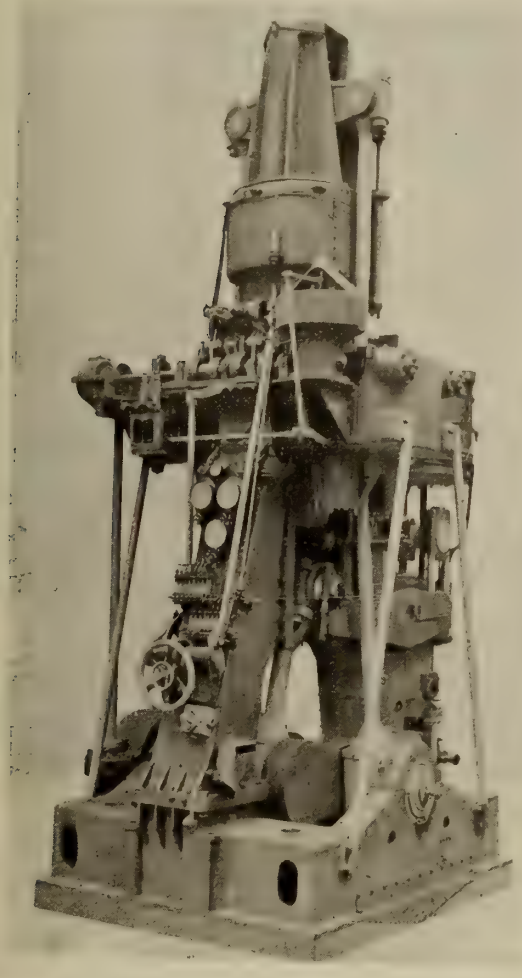
The cost of building a ship in Canada is now but little different from the English prices. Taking into consideration the fact that English yards are not in a position to take outside orders for some time, and that European nations are clamoring for ships, there should be lots of business for Canadian shipyards. The exchange

AUXILIARY MOTOR SCHOONER.

owners, and there are at present negotiations being carried on for the securing of a large order from France. This would cover contracts for over 100 ships. It is supposed that the Canadian Government would finance the building of these vessels, the stumbling block at present being the low French exchange rate. The growth of the Canadian shipbuilding business can be seen by a comparison of the tonnage under construction in 1914 with that in the present year. The figures for June, 1914, as already stated, were 14,184 tons gross, while those at September, 1919, were 210,800 tons gross. This was divided as follows: Great Lakes shipbuilding yards had 23 vessels of 53,833 gross tons under way, while on the Atlantic and Pacific coast 29 vessels, of 108,020 gross rate is, of course, a very adverse factor, but this could probably be overcome. Canada's deep-water yards can construct any type of cargo ship, and there are at present oil tank vessels being built on the St. Lawrence. The Canadian Government Merchant Marine have had 24 ships delivered this year, and the remainder, comprising 30 vessels, will be delivered during 1920. These ships are being built at fourteen different yards, situated on the Atlantic coast, River St. Lawrence, Great Lakes, and Pacific coast. They range in size from 3,500 tons deadweight to 10,500 tons deadweight, and will make a very useful fleet when completed. Already a goodly number of them are sailing the seas, bearing Canadian goods to different countries, and bringing their products in return.

Another phase of the marine business more particularly connected with upkeep and repair is the establishment of large drydocks of the floating type in Canadian harbors. Sydney and St. John on the Atlantic coast, and Victoria and Vancouver on the Pacific coast, will all have these docks in the near future. An adequate drydock, of the floating or permanent type, is a source of income to the vicinity it is situated in, as well as a splendid investment to the owners. It is also of indirect benefit to the shipowner in that its presence in certain localities exerts a favorable influence on insurance rates. These drydocks should bring many millions of dollars to Canadian pockets that formerly went to our Southern neighbors. Canada has built a large number of motor and auxiliary craft in the last few years, but no Canadian firm has yet tackled the making of the marine oil engine. However, that may come before very long, and be attended with as much success as the building of the marine steam engine.

The great expansion in shipbuilding called for a large number of auxiliary appliances for ship use, and Can-



OPPOSED PISTON TWO-CYCLE OIL ENGINE.

adian firms went into this business with as much energy as they displayed in the main effort. The manufacture of steam winches, windlasses, steering gears, pumps, etc., has been so successful that in some cases these machines have been sold to U.S. purchasers in direct competition with American builders.

In far-away Australia 12,000 miles from the heart of the Empire, the shipping shortage was felt acutely. There were thousands of bushels of wheat waiting for shipment, a lot of which was spoiled. It was piled along the wharves in many cases under temporary covering. Faced with the knowledge that ships could not be obtained, the Commonwealth Government resolved to build for themselves. They, therefore, gave contracts to several firms in the Commonwealth for twin-screw cargo steamers built on the Isherwood system. The first to be completed was the "Dromana," and eight more are under construction. Since laying down these ships the Government have decided on a programme of fifteen more to be built during the next two years. They have also ordered six 12,000-ton steamers in Great Britain.

The Losses of Germany

OF Germany's fleet of 2,159 vessels, aggregating 5,291,000 tons, which she owned at the beginning of the war, but little remains. At the time of the armistice probably 2,500,000 tons remained in her hands, and a considerable amount of this has been transferred to Allied nations. The actual tonnage remaining to her is not very clear. She built during the war about 740,000 tons. The ships so far divided among the Allies include the cream of her passenger fleets, which cost so much time and money to create. It is only poetic justice that the nation which started out to wipe all other flags from the seas should only succeed in nearly eliminating her own. There will be few tears of sympathy shed over the spectacle.

The quarterly returns issued by Lloyd's Register of Shipping make interesting reading, and the latest available statement is up to September 30th of this year.

There was on March 31st of this year a total tonnage under construction of 7,796,266 tons gross. This only includes vessels of 100 tons and over. Of this total the United Kingdom was building 2,254,845 tons, and the United States 4,185,523 tons. Canada had at this date 61 steel vessels of 168,935 tons, and 42 wooden vessels of 49,452 tons on the ways. The total of the other British Dominions was ten steel vessels, 46,866 tons gross, and 18 wooden ships of 16,987 tons. The remainder were divided over the European nations. These figures relate only to steam and motor vessels. There were in addition 165 wooden and 3 steel sailing vessels being built in various parts of the world, but their total tonnage was only 151,500.

On June 30th there were under construction 1,744 vessels of all types, the tonnage being 5,493,717. These included 1,155 steam and motor vessels of steel, 356 wooden steam and motor vessels, 5 steel sailing vessels and 228 wooden sailing vessels. Great Britain had in hand, 2,524,050 gross tons, the United States at the same time having 3,874,143. This shows an increase for Great Britain of 269,155 tons, and a decrease for the United States of 311,380 tons. Canada had under construction 55 steam and motor vessels of steel, totalling 163,493 tons, and 70 wooden vessels of 81,000 tons, 244,493 tons altogether. The other British Dominions were building 26 steel vessels of 70,256 tons and 13 wooden vessels of 11,647 tons. European nations accounted for the rest.

The British Show Gains

THE latest figures show the position at September 30th, and are interesting as showing the relative activities of Great Britain and the United States. The total for the United Kingdom is 781 vessels of 2,816,773 tons, while that of the United States is only 3,470,748. The increase in Great Britain over the previous quarter is 293,000 tons, and the decrease in the United States about 400,000 tons. Canada had 52 steel vessels of 161,853 tons and 49 wooden vessels of 48,950 tons. This is a slight decrease from the previous quarter, and shows that ships are being delivered with no new orders taking their place. The other Dominions have 33 vessels altogether, 24 steel and nine wood, but the tonnage is about the same as the last quarter.

That Great Britain is getting her large cargo liners back on the seas is evident from the size of the ships under construction. There are 157 vessels of 6,000 tons and over on the stocks, and 18 of these are between 15,000 and 25,000 tons. It is confidently predicted that the output for the full year will amount to 3,000,000 tons. The United States may be going to capture the seagoing trade of the world, but they will know they have been in a

race. There are no figures available for Germany or Austria as yet. Holland, Italy and Japan are the only other nations with over 200,000 tons under construction, beside Canada. France has about 180,000 tons.

The ferro-concrete vessel has practically gone out of existence, the only vessels of this type under construction being barges of small size. Wooden shipbuilding is also being relegated to the limbo of forgotten things, as far as large-sized ships are concerned. Both wooden and concrete ships are practically possible as far as being ships is concerned, but they have the fatal drawback of costing as much as a steel ship, with less deadweight capacity. This is a point that cannot be got around, and effectually disposes of their claims to recognition.

New Features of Ship Design

IF the concrete ship, which was to revolutionize all future marine construction, according to the enthusiasts, has slid quietly into oblivion, there have been other developments which are more permanent. Another feature of war-time shipbuilding which was introduced with a great flourish of trumpets, was the standard fabricated ship. This was particularly in evidence in the United States, where it was entered into on a large scale. Briefly, the idea was to introduce repetition production into the science of shipbuilding, and turn it into manufacture. A standard design of ship was decided on, and the making of the scantlings was given out to different contractors all over the country. These firms would cut, bend, and drill the various members to the drawings or templates furnished, and the manufactured shape would be shipped to any yard to be assembled. In Great Britain a number of vessels were built under this plan, but on the conclusion of the armistice, those not completed were sold to private owners in their uncompleted state. These private owners made the necessary alterations to fit them for the particular trade they were going in. Fabricated shipbuilding, as far as the United Kingdom is concerned, has been abandoned. In the States the experiment did not work out with the complete success expected, but there are a considerable number of these ships still under construction.

The greatest departure from old established practice was the introduction of the Isherwood system of construction. From time immemorial boat builders have built their craft with vertical rigs or frames attached to a longitudinal keel. These frames are spaced from 2′ 6″ to 4′ apart, according to the size of vessel, and the shell plating is riveted on to the skeleton thus formed.

The Isherwood system, so named after its originator, departed completely from this practice. The main scantlings of the vessel are laid fore and aft, or longitudinally, the vertical framing consisting of deep frames at considerable distances apart. This method allows for greater strength with considerably less weight of steel. It is being adopted more and more every day, and especially in the construction of oil tank vessels.

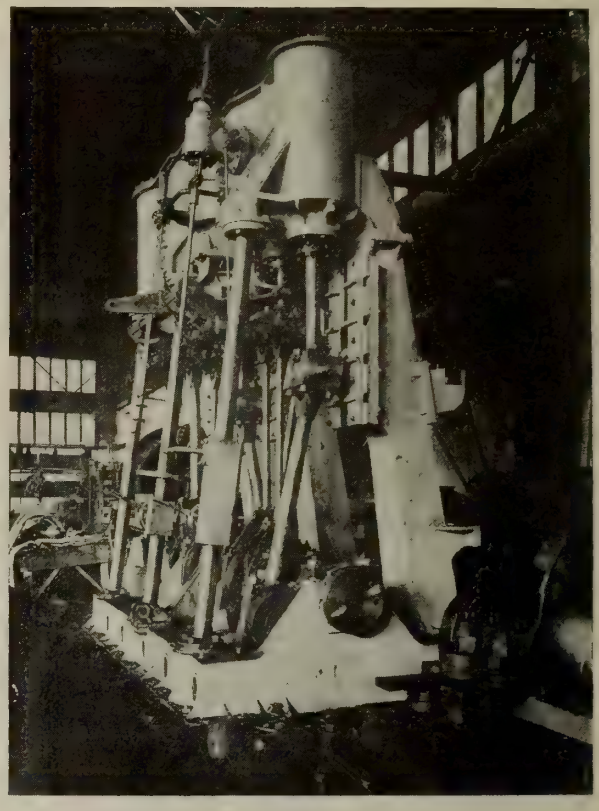
Electric welding, while for many years employed in the repairing of vessels, has only since the war been suggested as a means of construction. A vessel of 150 feet in length has been laid down, in the construction of which riveting will be entirely eliminated. She may be completed by the time this article will appear, and her performance will be watched with interest. Lloyd's Register Committee have also approved a design for a vessel on the Isherwood system, in which the plates will be attached to the longitudinal framing by this method.

Development in Marine Engines

WHEN we turn to the propelling end of marine design, the great advances made are apparent. After long years of successful and reliable operation, the triple and compound inverted vertical reciprocating engine seems doomed to pass away, and its place taken by the geared turbine and internal combustion engine.

From the inception of steam navigation on the ocean, development was comparatively slow. The first great revolution was the introduction of the screw propeller to take the place of the paddle wheel. Following this came the introduction of the compound expansion engine, the first trans-Atlantic steamer to be fitted with this type being the "Holland" in 1870. From the two stage expansion developed the three and four stage, and it was felt that the last word had been said in this direction. From 1881 to 1896 the only improvement made was in the direction of higher pressures, and slight gains in economy. Then in 1896 the engineering world was startled by the advent of the "Turbinia," a little vessel of 45 tons displacement, 100 feet long, 45 feet beam, which tore through the water at the speed of 34 knots an hour. This was achieved by the use of Sir Charles Parson's turbine. The British Admiralty immediately started experimenting with the new motor with the result that about 1905 this method was finally adopted for all the vessels of H.M. Navy.

The turbine was introduced into the merchant service in 1907, by the "King Edward," a Clyde pleasure boat. The



TRIPLE EXPANSION RECIPROCATING ENGINE.

Allan Line steamer "Victorian" was the first trans-Atlantic steamer to adopt it in 1905, and then came the two sister queens of the seas, the "Lusitania" and "Mauretania." Thus was the turbine definitely placed in supremacy for all high speed, high-class liners. The great bulk of the merchant marine still held fast to the reciprocating engine, the reason being that for speeds under fifteen knots the turbine was not efficient. This was because of the high speed, of rotation necessary for efficiency, which was only practicable on high speed ships. However, ingenuity in the engineering world was not to be stopped by this obstacle, and in 1910 the "Vespasian" was fitted with a reducing gear between the turbine and propeller, which allowed both to be run at their most efficient speed. The single reduction gear was so successful that it was developed further, and a double reduction gear introduced. The success of this may be estimated by the fact that in June, 1917, Lloyd's classed 23 vessels of 153,000 tons fitted with either single or double reduction turbines, and in the following twelve months 72 vessels

of 367,960 tons, while in the year ending June 30, 1919, they classed 183 vessels of over 1,000,000 tons. The largest of these vessels was the oil carrier "San Florentino" of 12,842 tons. This does not take into account war vessels, of which the "Renown" is an outstanding example.

Another development has been the combination of steam turbines direct connected to electric generators, which drive motors connected to the propeller shaft. The best example of this style of equipment is the U.S. battleship "New Mexico," while in England the "Wulsty Castle," a vessel of 3,566 tons, has been so fitted.

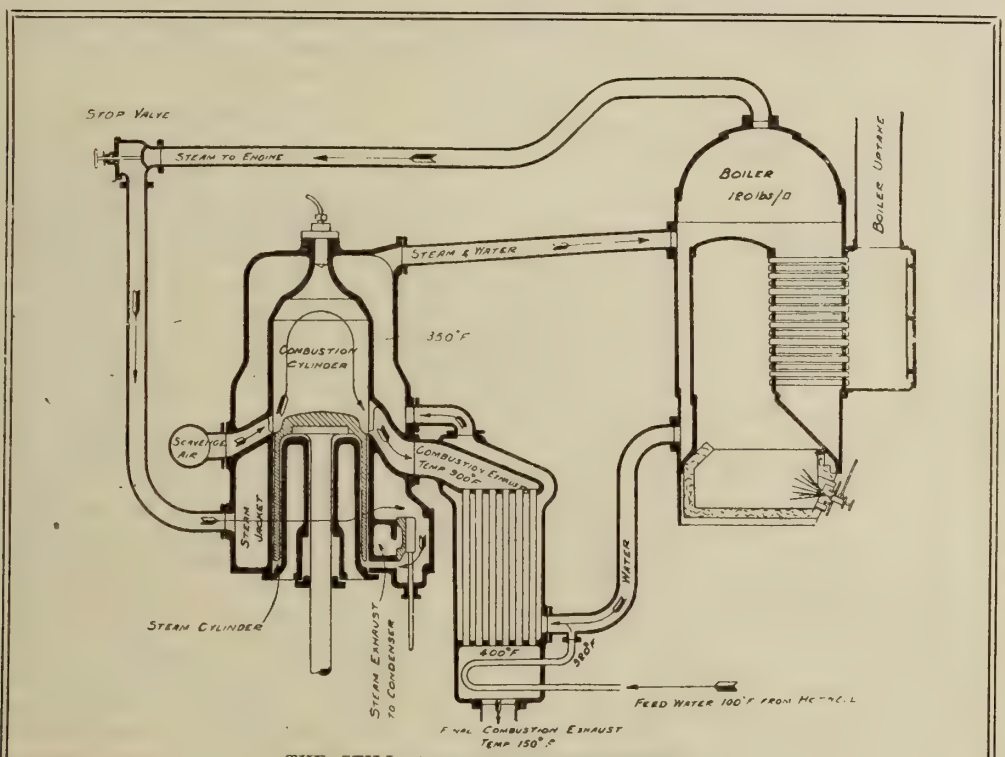
The adoption of the internal combustion engine for sea-going vessels dates from 1910. In this year the "Vulcanus," of 1,179 tons, was fitted with a Diesel engine of six cylinders, 15¾ inches diameter by 23⅝ inches stroke. The development in this type of engine may be seen by the fact that the latest and largest vessel of this type is the "Glenapp," fitted with two sets of engines driving twin screws. Each set consists of eight cylinders 29½ inches diameter by 43 5-16 inches stroke, the horse-power of the two being 6,400. The "Glenapp" is 7,374 tons gross, about 11,000 tons deadweight.

The second consideration is weight and space occupied. These must be a minimum as every cubic foot occupied by the power plant, and every ton displacement, is obtained by sacrifice of earning, or cargo carrying space.

Fuel economy comes next. Not only in the actual fuel used per horse power is economy beneficial, but greater economy in fuel consumption means less fuel carried for a certain length of voyage. This enables more cargo to be carried. If the voyage is a long one, it means less calls for replenishing fuel stores, saving money in pilot and harbor dues. It also enables the fuelling to be done where that commodity is cheapest, or at least leaves some alternatives.

Maintenance and operating costs come next. The prime mover which requires the minimum of attendance, and consumes the least supplies, may be more desirable than one which is cheaper in first cost, or slightly more economical in coal.

Regarding the question of reliability, there is nothing to choose between the reciprocating engine and the



THE STILL OIL AND STEAM ENGINE.

The Engine of the Future

IT will be seen by the foregoing that there are rivals a-plenty for our old friend the triple expansion engine. Which of them will eventually gain the palm, and occupy the position so long and honorably held by it in the marine world? To answer that we must look into the question a little deeper than we have up to the present.

In deciding on the type of power plant to be adopted in a ship, several factors must be considered, all of which have an important bearing on the final decision.

The most important is reliability, or freedom from danger of breakdown. The great bulk of the world's trading is carried on by ships that have to be away from their home ports for months at a time, sometimes even years. It is absolutely necessary that the motive power must be capable of long sustained running with only minor adjustments. A major repair carried out in a foreign port may easily devour the profits of several voyages.

geared turbine. The triple expansion engine has moved the world's fleets around the oceans, with a remarkable absence of breakdowns. The only thing that made them a total breakdown was the breaking of a tail end shaft, and these accidents were few in proportion to the number of vessels engaged. In the early days of turbine operation, some trouble was encountered, due to the stripping of blades, but this has long since been eliminated. Turbines with and without reduction gears are now giving as reliable service as the older reciprocating engines.

Taking up the subject of weight, the geared turbine installation has the advantage of the reciprocator. In figuring on the total displacement for each type of engine, the fuel consumption must be taken into account. The installation which uses the least fuel allows for a greater amount of cargo being carried. The consumption of fuel for all purposes with a good triple expansion engine may be taken as 1.6 lbs. per I.H.P. per hour, while that of the geared turbine will be about 1.3 lbs. per S.H.P. per hour. I.H.P. means indicated horse power, while S.H.P. means shaft horse power. The shaft horse power will be in the turbine installation about 96 per cent. of the I.H.P., so

that consumption per I.H.P. will be about 1.2 lbs. This is taking the fuel used to be coal. If steam is generated by oil, the consumption will be less in both cases, but the real factor is that the steam consumption of the turbine is least. The consumption of fuel figured on here includes that necessary for driving the auxiliaries, which must be taken into account. We see, therefore, that the geared turbine is equal in reliability to the reciprocating engine, and is the better as far as weight and fuel consumption are concerned. In first cost the geared turbine installation is from 3 to 4 per cent. dearer than the reciprocator. This disadvantage is more than outweighed by the other advantages.

The turbo-electric drive, while slightly more economical in steam consumption, is much heavier than the geared turbine, and is also higher in first cost. The complicated electrical connections call for much more skilled attendance than is required for the geared turbine, and we may safely say that for the general cargo carrying steamer its adoption is unlikely. For naval vessels it may have a field.

A further combination which has proved very successful in a certain class of vessel is the reciprocating engine exhausting into a low pressure turbine. This is the arrangement adopted in the famous "Olympic," and gives economy of operation with flexibility in manoeuvring. However, it is with the typical cargo carrier of 6,000 to 10,000 tons that we are more immediately concerned. This type is the backbone of the merchant marine.

The Oil Engine's Future

WE will now consider the latest type of marine engine, and the one which many people believe will be the standard type in a few years. The internal combustion engine has a good many points in its favor with but few against it, and the latter are gradually being eliminated.

In the first place, the use of the internal combustion engine eliminates at once, boilers, coal and boiler room crew. Instead of large spaces being occupied to store coal, the oil is carried in the ballast tanks. This, of course, is true of an installation using oil fired boilers, but the difference is that the internal combustion engine uses only about one-half the fuel consumed by the most economical steam motors. In a steam engine the heat losses start at the furnace, and go on to the condensor. The result is that in a reciprocating engine the overall efficiency is about 12 per cent. In a turbine it is about 16 per cent., while in the oil engine it is about 30 per cent. The thermal efficiency of the oil engine is higher by far than any steam engine or turbine can ever reach.

The first cost of an oil engine is probably 20 per cent. higher than the geared turbine type, but the crew necessary is only about two-thirds that of the latter. This coupled with the much lower fuel consumption places it far ahead as an economic factor. While the saving of weight in the engine itself is not great compared to the turbine installation, the increased cruising radius, or the smaller quantity of reserve fuel required, is much more important than the actual engine weight.

It has had several disadvantages to fight against. The first, and one of the greatest, is the limitation of power that could be developed in each cylinder. This limitation precludes its use in very high-powered vessels. About 500 H.P. per cylinder would seem to be the limit at present, but a further adoption of the two-cycle type may increase this considerably. Difficulty of reserving and starting were also a drawback, but these may be said not to figure in the latest types. Difficulty of finding oil stations militated against both oil fuel and the oil engine for some years, but is practically overcome now. The great drawback seems to have been the liability to irreparable breakdown and the difficulty of finding highly trained attendance. With improvement in design, and greater experience the first difficulty should gradually vanish. With the more general adoption of this engine the men will be trained. British engine builders are developing their own designs, and improvements are taking place frequently. One of the most promising of these is the Still engine, in which the exhaust gases are utilized to evaporate the water in the cylinder jacket, the resulting steam being used on the opposite side of the piston. By this method a still greater efficiency reaching as high as 40 per cent. has been obtained. The development of the two-cycle opposed piston type will result in reducing the weight per horse power, allowing of larger units, and decreasing the number of cylinders required for a given power. Taking it all round, the oil engine promises a reduction in weight, space, attendance, and fuel, a combination which should result in its general adoption for all medium speed cargo vessels of 6,000 to 10,000 tons.

The first-class express steamer and the warship will no doubt be propelled by the geared turbine for some time to come, while the mixed cargo and passenger liner of 17 to 20 knote will no doubt use the combined reciprocating and turbine installation in many cases. With the growing need of economy in both coal and oil, and the steady increase in wages, marine engineers must keep on their investigations to determine the most efficient motor. Special trades require specialized treatment, but the outlook for the internal combustion engine is good. Some day the practicable internal combustion turbine will be discovered, marking another great stride in the science of marine propulsion.

The Outlook in Canada

CANADA has a large number of well-equipped yards to-day, with efficient managing and operating staffs. There are between the actual building and the contributory trades probably 40,000 men employed. The pay roll amounts to something like $40,000,000 a year. Every British yard is booked up for two years to come. That means that the most dangerous competitor is removed. All Europe wants ships, and must get them built outside of their own countries. The exchange rate operates just as much against the U.S. as it does against Canada, putting them on an equality. Canadian yards can build as well and as cheaply as United States yards. It is up to them to go after the foreign orders and keep their yards going. If they can be kept in successful operation for the next three or four years, they should be in a position to face the future with every confidence. Make shipbuilding a permanent industry of the country.

According to "Der Schweizerische Eisenwarenhandel," a file when new, if viewed under a strong magnifying glass, will be found to consist of fine points or teeth, so far as the cutting surface is concerned, and if passed over a piece of hard steel or other hard resistant metal, it will be found that the majority of these teeth have splintered off, leaving a very indifferent set of cutting points. For this reason, it is best always to use files first on brass and copper alloys, as this saves the teeth from breaking away, while the heat engendered by the working friction somewhat anneals them, and makes them fit to follow on with wrought iron and mild steel, harder steel and cast iron taking the last place, and after these the files want re-cutting, if they be thick enough.

A gas stove is now available for housekeepers that has a heat measuring device for the oven. A thermostat is made use of, which automatically maintains oven heat at a constant temperature, and also enables the cook to select at will any pre-determined temperature. The regulator will automatically maintain it for any definite period.

Fitted with flanged steel wheels, a motor truck was recently used to reclaim an abandoned railroad spur line extending to a deserted lumber camp in Montana, thus saving a large amount of money for the company. A small flat car served as a trailer on which were hauled the rails. The truck used was standard make, one-half ton, and in the first month travelled 3,300 miles, or about 108 miles daily.

A Series of Studies in Practical Marine Engineering

These Articles Will Appear Monthly and Will Take Up the General Principles Underlying the Design, Construction and Maintenance of Marine Engines and Boilers—For Apprentices and Students Generally

By T. H. FENNER, Extra Chief Engineer, M.I. Mar. E., London

IN previous articles we have discussed the nature of heat and its effects on different bodies, fluid and gaseous. Before going on with the study of heat as applied directly to the steam engines, we will endeavor to form a closer acquaintance with the working fluid — steam. There are certain characteristics which it is absolutely necessary for the student to understand and be familiar with.

Steam, as it comes from the boiler to the engine, or as it issues from a nozzle direct from the boiler, is in the condition known as saturated. Most of the calculations in connection with steam engines are made with steam of this kind. Saturated steam is steam at the same temperature as the boiling point of the water from which it is formed. It may be defined as steam which holds no water in suspension, but which would condense with any lowering of temperature. Some writers define it as steam which is in contact with the water from which it is generated.

Superheated steam is steam which is at a higher temperature than that which corresponds to its pressure.

Saturated steam has certain properties, all of which change if any one of them change. These properties are six in number. There is the temperature, pressure, latent heat, total heat, weight of a cubic foot, and volume of one pound of steam. The temperature of the steam corresponds to the boiling point of the water. The pressure is always the absolute pressure, measured from vacuum. The latent heat is the heat or number of B.T.U.'s required to turn water at the given temperature to steam at the given temperature. The total heat is the total number of B.T.U.'s measured from 32 deg. to the boiling point at the pressure concerned, and including the latent heat. The weight of a cubic foot of steam increases or decreases as the pressure is high or low, and the volume of one pound of steam will be more or less as the pressure is low or high. These properties or relations of steam have all been determined by scientific experimenters, and the results for all pressures from 0 to 300 pounds per square inch absolute have been tabulated, and are known as steam tables. These tables are included in every text book on steam engineering and also in practically every pocket-book. They occupy too much space to publish here, but the arrangement will be shown, as also some examples of the application of the tables.

The two examples given are steam at 14.69 pounds absolute, or at atmospheric pressure, and steam at 100 pounds absolute, or 85.3 pounds gauge pressure

Pressure above °	Temp. Deg. Fahr.	Temp. above 32 °	Lat. heat at Pressure	Total heat above 32°	Weight of Cubic Ft.	Volume of 1 lb.
14.69	212	180.531	966.069	1146.6	.037928	26.37
100	327.625	295.093	883.773	1181.866	.230293	4.342

The first column is of course the absolute pressure of the steam. In the second column is given the temperature of the steam, which is also the temperature of the water. The third column is the quantity of heat required to raise the temperature of the water from 32 degrees Fahr. to the boiling point at the indicated pressure. By subtracting 32 from the second column the third column can be found very closely. The difference between the result found by subtracting 32 from the temperature and the figures actually given in the steam table, is due to the correction made for specific heat, which has been discussed in a previous article. The fourth column is the number of units of heat required to turn water at the given temperature to steam at the same temperature, in other words the latent heat. The next column gives the total heat, which includes the heat above 32 deg. and the latent heat, and therefore can be obtained by adding together columns three and four. In the next two columns are given respectively the weight of a cubic foot of steam and the number of cubic feet occupied by one pound of steam at the given pressure. A further column is given sometimes showing the relative volume of the steam to an equal weight of distilled water. Some tables give more exact values than others, and closer variations. The most complete and accurate table, and the one usually adopted by engineering authorities is that of Mark and Davies, and this is embodied in most good text books.

Examples of the Use of Tables

The steam tables are in daily use in many of the everyday problems of the power plant. For instance, the standard boiler horse power is the evaporation of 34½ pounds of water per hour from 212 deg. Fahr. to steam at the same temperature. Now supposing that a boiler is evaporating 1,000 pounds of water per hour, and we wish to discover the horsepower. We must determine first the temperature of the feed-water entering the boiler, and the pressure of steam carried. Suppose we have the feed entering at 180 degrees and the steam pressure is 150 pounds per square inch gauge. Turn up the steam tables, and in the second column we find that steam at 165 pounds absolute pressure, corresponding to 150 pounds gauge, the temperature is 366 degrees. That is 366-32 =334 degrees above 32 deg. However, the feed-water is at 180 degrees, that is 148 degrees above 32. Therefore the total amount of heat to be added to the feed-water to bring it up to the steam temperature is 334-148 = 186 heat units. The latent heat of the steam is 856.2, which, added to the 186 necessary to raise the temperature makes the total heat to be added to the water 1042.2 B.T.U. Now to evaporate water at 212 deg. to steam at 212 deg. requires only 965.2 B.T.U. By dividing the latter figure into the figure found by the steam table, we get an evaporation factor, or in other words, the ratio of the heat required at the feed temperature and steam pressure of the actual boiler, to that required from and at 212 deg., the standard figure. This will be

$$\frac{1042.2}{965.2} = 1.08$$

This evaporation factor is applied in this manner. If the boiler was evaporating 1,000 pounds per hour from and at 212 deg., the horsepower would be $\frac{1,000}{34\frac{1}{2}} =$ 28.9, say 29 horsepower. This must be multiplied by the evaporation factor 1.08 to get the correct horsepower, thus $29 \times 1.08 = 31.32$ horsepower. In connection with this there are two terms much used, "actual evaporation" and "equivalent evaporation." Actual evaporation is the actual amount of water evaporated per hour, irrespective of temperature and pressure, the equivalent evaporation being the actual evaporation corrected for feed temperature and steam temperature. The equivalent evaporation in the case just considered would be $1,000 \times 1.08 = 1,080$ pounds. Suppose that the steam pressure had been 100 pounds absolute, and the feed-water at 150 degrees, then the steam temperature would be 327.9 degrees. The total heat of the steam would be 1181.4. As the feed-water was at 150 degrees the excess of feed temperature above 32 must be subtracted from the total heat, 150 — 32 = 118; 1181.4 — 118 = 1063.4. The evaporation factor would be higher, namely, 1.11.

If we have a tank containing water at 40 deg. Fahr., and there are, say 500 gallons in the tank, how much steam at 60 pounds per square inch gauge must be blown into it to raise it to a temperature of 200 degrees?

We have 500 gallons, which is 5,000 pounds by weight. We have to raise the temperature 200 — 40 = 160 deg. The total heat required will be $5,000 \times 160 =$

800,000 B.T.U.'s. Steam at 60 pounds gauge has a temperature of 307.5 degrees, and its latent heat is 897.5. Each pound on condensing gives up 897.5 B.T.U.'s, and in addition gives up 307.5 — 200 = 107.5 deg., a total of 897.5 + 107.5 = 1005. Divide this into the total heat required and we have $\frac{800,000}{1,005} = 796$ pounds of steam.

A reliable thermometer in a steam pipe will, with the aid of the tables, give the corresponding pressure. Knowing the point of cut-off of the slide valve of an engine, the volume of steam per stroke can be found, and the weight of steam per minute can be obtained by referring to the weight of a cubic foot of steam at the given pressure. When any one characteristic of the steam is known, every other property can be found by a glance at the tables. Any variation of one property is attended by variation of the others, as long as the steam is saturated.

Superheated Steam

Superheated steam must be out of contact with the water it is generated from. If not, the superheat will be absorbed by the water and the temperature of the steam and water equalized. Steam is usually superheated by being exposed to hot gases from the boiler on their way to the chimney, and a portion of the heat that would otherwise be wasted is absorbed by the steam. A peculiarity of steam, when heated above its normal temperature, is that the specific heat is lowered, being about .5. This means that only one-half a B.T.U. is required to produce one degree of superheat in one pound of steam. In modern practice steam is superheated to a temperature of 500 to 600 degrees. It is used particularly in turbine practice, but has also found favor in reciprocating engines. The advantages of using it will be explained in later articles dealing with the steam engine.

Some Interesting Remarks on the Use of Oil

Extracts From a Paper Read Before the Institute of Petroleum Technologists

By SIR PHILIP DUMAS, C.B.

IN JULY, 1912, I was sent for one morning by Lord Fisher, and told that he had selected me to serve as the principal secretary of the Royal Commission on Oil Fuel and Engines. I knew nothing of the subject whatever, but Lord Fisher was enthusiastic, and as he has always proved right in the long run, I accepted. That afternoon I got hold of Sir Boverton Redwood's book and others, and passed some of the most fascinating hours of my life in the realization of the importance of the subject, and that I had happily come in touch with probably the greatest existent factor for sound economic advance and efficiency in many of the engineering problems of the future, and that here was a real help towards Buckle's third great cause for the decline of the warlike spirit in producing better means of locomotion.

On the other hand, I also realized, and almost as quickly, that never had a splendid natural source of power been so inefficiently sought for and controlled, that although to be found everywhere, the supply was comparatively limited in volume, was being wasted, and that as things were, even then it could not last, and I may go as far as to say that during the progress of the Royal Commission, by much evidence from the greatest authorities on the subject, these opinions of mine were constantly fortified.

It seems to me that anyone with a grain of imagination can foresee motor launches, motor lighters and motor lorries at work in tens of thousands before long, and at the same time liquid fuel will be required for shipping, oil engines and the huge number of motor cars and aeroplanes which but a few years will see in the possession of everyone.

Meanwhile and for the near future the value of oil for the advance of civilization and the increase of production is such that the most minute and systematic search should be made for it everywhere. Are we making such a really systematic study of the sources of crude oil in the world, or indeed training and employing a sufficiency of geological experts to carry out the work? I fear the answer can be but no, and yet there are thousands of able and adventurous young men in England with brains to be trained and used, and you should do it.

Plenty of Oil Available

Also can anyone doubt that there are vast fields of oil yet to be located? Why, twice in my life, once in the Indian Ocean and again on the West Coast of Africa, I have steamed through oil, and the atmosphere reeked of it. It is up to the great and wealthy companies—thank God for competitive monopolies and capitalists—to search for and locate the sources.

And we know of and suspect vast deposits of shales—hundreds of thousands, probably millions of square miles of such deposits of great depth: indeed an enormous and overwhelming source of power to be tapped and used, and used economically. Are the great oil companies preparing for the inevitable future exhaustion of their fields by purchasing these, and carrying out systematic research in good time into the most economic method of extraction of the oil and its use? Of course I know that a great deal has been done in this direction, and even now companies are exploiting the shale fields of Great Britain in many localities, but one wants it on a larger scale, and above all, to increase our production at home. The Dorset shale we know produces good and useful oil, which, with some of the sulphur extracted, can be mixed with purer types and so used to advantage. This source should certainly have been brought into use during the war.

The Need for Oil Experts

Shortly, very shortly, the owners of all ships and engines will realize its efficiency and present cheapness, the cry will arise for it everywhere, and there is only one-twentieth of our requirements. So again I say, put your army of experts—a very small army at present, I am afraid—on to systematic research as regards shale, and it will prove well worth your while. Indeed any system of production of oil will unhappily be eventually well paid for by the war. This war has been largely waged on oil. The next one will be nearly wholly so, and Bismarck's dictum of "Blood and iron" brought up-to-date would read "Blood and oil." Therefore yet once again I say: Find and conserve your oil, and in so doing it may well prove that you will preserve your country—this England, which, with a heart of oak and set in a silver sea, quite naturally requires something of the creosote type to keep it sound.

Here indeed is the type of engine of the future, and is it really true that we cannot get the internal-combustion engine on a large scale? Literally I do not believe it, and I beg you not to listen to the despairing tones of our experts who say it is impossible. Remember that the very fact of being an expert means that he has gained in experience and lost in imagination, that few are young men, and to those the future belongs, and further, let your memories revert to that very instructive sermon preached from the stage a few years ago and called "Milestones." I beg you to preach its advent everywhere, and do not mind if people deem you foolish. Of course, it has got to come, and it will come, and with its arrival will cease the abominable scandal of wasting precious oil by burning it under boilers.

£100,000,000 Wasted Through Lack of Motor Ships

Preach its advent sufficiently, and with it the inventor will arise: one comparable with Watts, and a greater than Sir Charles Parsons, and incidentally he will command what I saw called the other day, a Rockefeller fortune. Largely ow-

ing to the lack of a suitable internal-combustion engine for merchant shipping I compute that roughly a hundred million sterling per year is wasted, and something like a half of all the oil produced in the world is clean thrown away. Of course it would be easy to produce figures in support of what I say, but no one listens to or understands them, and indeed it is wise, considering how easy it is to manipulate them.

But indeed, and indeed it is true that the advent of the internal-combustion engine will save vast sums, and when one thinks over the vast waste of value, power and efficiency in burning oil to raise steam, it should reduce all the happy owners of oil to tears; that is unless they are ignorant of the fact that their fortunes are being thrown away. To you who do understand I would say that in the intervals of weeping you should constantly ponder over the realization that with its arrival on a really large scale, the life of your oil fields, and incidentally your fortunes, may well extend to the neighborhood of another hundred years.

With that pondering will come the determination to forward the development of the internal-combustion engine, but for heaven's sake get on with your pondering and let the solution of that, as with all other great advances, come from Great Britain.

Oil Engine Progress Abroad

Up to date I am given to understand that the big experiments are still in the hands of the Germans and other foreigners. The Germans! Good God!! I know Germany and the Germans through and through, and man for man, you are better than they are in geology, chemistry, and engineering in just as great a degree as you proved to be in fighting. Realize that fact, and endow and employ young Englishmen—or as it is a case of an engine perhaps I had better say a Scotsman—to devise and develop this great want of the world.

Recollect that there is no time to lose. Already the Germans, Dutch and Danes have had a measure of success, and meanwhile there is no actually all-British internal-combustion engine on the market at all. And yet you have in England to-day—I hope in this room—probably the greatest living expert on the subject, whose brains and experience are worth millions to any one or group of you who is wise enough to catch him at once. When you leave here to-day I beg of you to try and find out what have been the profits of that admirable firm called Burmeister and Wain in the past few years, and form a similar British firm and make your own millions. If I had any capital—but for thirty-seven years I was an underpaid naval officer, so, of course, I have none—I would make them myself. Believe me they are just waiting for the first of you who is wise enough to pick them up.

For heaven's sake do get a move on. Until you do we see an ever-increasing wicked and avoidable waste, and I beg and implore of you to stop it, and the equally true fact that the oil industry is tinged all along the line with waste: abominable, avoidable waste.

BRITISH ADMIRALTY CHAIN REQUIREMENTS

The Admiralty requires all links of all chains to be made from rolled bar iron. It also requires the end shackles for cables up to 2 9-10 in. in diameter and the joining shackles for cables up to 2¾ in. in diameter to be forged from cable iron, each made in one piece with the eyes turned in the direction of the grain of the iron and welded. Larger shackles may be forged from best selected scrap iron. Shackle pins for cables of 1½ in. in diameter and above are to be forged from scrap iron; for cables of smaller size they may be of cable iron. Scrap iron used for forgings must not contain an admixture of steel; its tensile strength must not be less than 22 tons per square inch, and it must have an elongation of at least 22 per cent. on a length of 8 diameters of the test piece. A bend test 1 in. square must withstand without fracture being bent cold through an angle of 180 deg. with an internal radius of bend not greater than 1½ in.

The bar iron used for links, etc., must have a tensile strength of not less than 23 tons per square inch for sizes under 2¼ in., of not less than 22½ tons per square inch for sizes from 2¼ in. to 2 9-16 in.—both sizes inclusive—and of not less than 22 tons per square inch for larger sizes.

In all cases the extension must not be less than 22 per cent. on a test piece of 8 diameters length. Bars of 1 in. in diameter and above must admit of being bent cold through an angle of 180 deg., and bars under 1 in. of being bent cold to the same radius as the end of the link for which they will be used. Bars of large size may be cut longitudinally through the centre. Each portion must admit of being bent cold through an angle of 180 deg. with the original outside surface in tension, the inner radius of the bend being not greater than 1½ times the thickness of the test piece. A notched cold bend test should show good fibre. A hot forge test is made as follows: A hole one-third of the diameter of the bar is punched at a distance of one and a half diameters from the end of the bar. The hole is then drifted out to one and a quarter times the diameter of the bar, the side of the hole is split, and the ends must then admit of turning back on either side of the stock without fracture. In Admiralty cables the studs are made either by stamping or forging from open-hearth mild steel bars.

A BIG JOB FOR TYNESIDE

The great Tyneside shipyards of Sir W. G. Armstrong, Whitworth & Co., Ltd., are now undertaking a very extensive amount of mercantile construction.

In addition to other work they are carrying out one of the most extensive reconditioning contracts ever undertaken by a shipbuilding firm. This contract is for the complete overhauling and refitting of the giant quadruple screw Cunarder "Aquitania" after her four years of strenuous war service.

This vessel, the largest which has ever entered the Tyne, is now safely berthed at the fitting-out quay of the Armstrong yard, where she will remain until completed.

An important feature of the work to be carried out is the equipment of the vessel for the burning of oil fuel. The advantages of this system for passenger and cargo vessels are nowadays being widely recognized, and in the present instance great economies will be effected. A reduction of over 300 hands will become possible, and this, together with the abolition of coal bunkers will greatly increase the available carrying capacity of the vessel.

As an indication of the magnitude of this undertaking, it is interesting to review the details and dimensions of the "Aquitania," which was taken over from the builders by the Cunard Co. in 1914.

Length overall	902 ft.
Breadth	97 ft.
Depth of shelter deck	64½ ft.
Draught (corresponding)	34 ft.
Gross tonnage (approx.)	46,150 tons
Displacement	49,430 tons
Weight of hull (approx.)	29,150 tons
Weight of machinery (appro.)	9,000 tons
Total deadweight	11,280 tons
Horsepower	56,000 tons
Estimated speed	23½ knots
Total accommodation (passengers and crew)	4,230

Although one of the world's greatest vessels, the "Aquitania" in no way taxes the capacity of the Armstrong yard, the larger berths of which are designed to accommodate vessels of greater dimensions than any ocean greyhound yet projected.

Great efforts were put forward by these yards during the war, and it is interesting to recall that at one time no less than four large and powerful vessels were laid down at one time on a single berth, and that not the largest, while on another occasion six large submarines were in course of construction, also on a single berth.

While still fully equipped for the building of war vessels, the Armstrong, Whitworth yards have been thoroughly reorganized with a view to the rapid construction of merchant vessels, which are so urgently needed to repair the wastage of the war throughout the world.

New Engineering Firm.—The firm of Clayton, Neil & Jones, with head office in Montreal, and the Toronto branch at 152 Bay street, Toronto, is the latest addition to the engineering industry. The new firm will manufacture all lines of general machinery, and make a specialty of marine auxiliary machinery, including deck winches, steering engines, pumps, etc. Mr. Clayton is very well known to the shipbuilding firms of the country, with whom he has a valuable connection. Mr. Neil, who will look after the manufacturing end, is a practical production engineer of great ability, while Mr. Jones is a specialist on pumping machinery. The firm should have a very prosperous future.

Eastern and Western Canada Marine Activities

January Correspondence

AFTER a lapse of over three years a direct steamship route will be established this spring between Montreal and St. John, Newfoundland. Two new boats of 2,800 tons will be ready about the first of July and one of 1,200 tons will be put on the route as soon as navigation opens. First-class accommodation for about 60 passengers will be provided on the larger steamers.

Negotiation have been completed between the Canada Steamship Lines and the Davie Shipbuilding Company of Lauzon, Quebec, whereby the former will co-operate with the construction firm in the operation of the plant. Early in the year the yard resumed building operations which had been suspended for several weeks. Work now on hand will give employment to about 1,500 men and new contracts for additional boats are expected.

If present plans materialize the scope of the Dominion Marine Association will be enlarged so as to take in representatives of ocean-going vessels under Canadian Register. The custom has been to confine the membership to those associated with the Great Lakes or inland water traffic. For some time past is has been proposed that Canadian vessels doing a trans-Atlantic trade should have a Canadian register. Should this become effective the C. G. M. M. and the C. P. O. S. would be eligible for membership in the Dominion Association.

In connection with the American Association of Port Authorities, it is interesting to note that a change has been made in the way of news distribution in the monthly bulletin that has recently been issued from the office of the secretary, M. P. Fennel. Formerly, the issuing of the bulletin was an annual affair, so that the new departure will provide current news to the members within a more reasonable period.

Intensified operations in the Cape Breton coal regions of the Dominion Steel Corporation has resulted in the mining of increased quantities of coal. Official statements give the production for the month of December as 312,891 tons, an increase of over 40,000 tons over the corresponding month a year ago. Officials of the company state that every facility is being provided to bring the mines up to maximum capacity.

Canada's effort to grasp the post-war opportunities for marine development is emphasized in the activities of the Canada Steamship Lines in consolidating all of the inland routes and branching out into an ocean traffic corporation as well. In addition to establishing a direct line to France by associating with the Compagnie Canadienne Transatlantique, the company has acquired the old Quebec Steamship Company, which operated a line of steamers between New York and the West Indies. They have also become agents for a large group of steamship lines operating between these points.

City and Board of Trade officials of St. John, N.B., have decided to memorialize the Federal Government to commence early operations in the development of improvements and extensions to the port, to take care of the rapidly increasing trade to this country. In addition to breakwater extensions and increased accommodation as to ship berths and grain elevators, the installation of a wireless station came into discussion and this will probably be included in the program submitted.

The first year of peace was a great year for Montreal port. During the season of navigation 786 ships, 702 of which were Trans-Atlantic, visited the port. The total tonnage was 2,700,000, of which 1,646,532 were British. Inland transportation amounted to 7,499 vessels, of 4,357,734 tonnage. There were 84 vessels engaged in river and gulf traffic, as against 30 in the previous year. Navigation opened on April 14 and closed December 12. The first ocean vessel arrived April 22, and the last ocean departure was on December 10.

Shipments of Canadian products, approximating 30,000 tons a month, are going to Greece through the agency of the Hellenic States Trade Commission to Canada, with headquarters at the Drummond Bldg., Montreal. The bulk of this freight has been in grain, food and clothing as these are the present essentials needs of that country. Stamos Zographakis, who is in charge of the Canadian office, stated that, so far, the trade developed by individual concerns was on a very small scale, and that personal representation would be necessary before increased business could be expected.

After nearly a month's helpless drifting in the ice in the Lower St. Lawrence, in her effort to reach open water, the Canadian Government Merchant Marine vessel Canadian Spinner, with the aid of the Montcalm, succeeded in getting clear of the ice floes and reaching the Port of Sydney. At various stages of the voyage it was thought that the vessel would meet the same fate as the Canadian Recruit, which was abandoned after being driven ashore near Vache Point, but the efforts of the officers and crew were finally crowned by success, and the vessel is now undergoing light repairs before taking her maiden voyage.

In anticipation of an increased Atlantic trade during the years 1920-21, the Canadian Pacific Ocean service will add three new vessels to the route, The boats will be of the Minnedosa type, improved and enlarged, and will bear the names, Montcalm, Matepedia and Montmorency. The first two are being built by John Brown and Company, on the Clyde and the third is under construction by the Fairfield Shipbuilding and Engineering Company of Govan, Scotland. Each vessel will have a gross tonnage of 16,000 tons, being 566 feet long, 70 feet beam and a depth of 51½ feet, and will be oil fired. They will likely be placed in service toward the close of the present year.

Canada's present standing and her future possibilities cannot be better shown than by a statement appearing in the recently published annual of the Port of New York. In part it reads:— "An interesting point is the fact that Montreal, if a port of the United States, would rank second or next to New York, the value of the foreign commerce now exceeding $700,000,000 in value. As it is, Montreal holds second position in the value of foreign commerce among the ports of the American continent." In regard to other phases of Canadian activity, it is interesting to note the favorable comment that is made in connecting with the proposed canalization of the River St. Lawrence and the bearing it would have on supplying the central American States through the medium of comparatively cheap water transportation.

The recently organized Canadian Association of Shipbuilders and Engineers has for its aim the better protection of all those connected in any way with the construction and repairs to all classes of vessels. Some of the objects of the organization are the standardization of prices and rates, the preparing of estimates based upon current prices of material and labor, interest and overhead charges, engaging and discharging of employees, legislative action, etc. That the new association recognizes the new trend of industrial conditions is shown in the statement of the secretary, W. J. Gerrard. "It is absolutely essential for the welfare of the shipbuilding industry," he said, "that there should be an organization of this nature, so that those engaged in the industry may be in a position to show the Minister of Labor that they are in a position to deal collectively with their employees from coast to coast. It is generally recognized now that the time for individual bargaining is gone and that the only way to promote and maintain industrial peace is for organizations representing employer and employed to come together for conference."

Realizing the necessity of more adequate facilities for aiding early and late navigation on the St. Lawrence, during the breaking up of the ice in the spring and the formation in the fall, the Hon. C. C. Ballantyne, Minister of Marine and

Fisheries, has stated his willingness to give the matter every consideration. The fate of the Canadian Recruit and the long and dangerous passage of the Canadian Spinner, has emphasized the immediate need of additional ice breakers for use on the St. Lawrence. In a letter recently written by the Minister to J. T. Ross, chairman of the Quebec Board of Trade, he said: "I have quite realized for some time that the facilities available for the purpose of assisting vessels to navigate the river after severe weather sets in are quite inadequate. For reasons that I am sure will commend themselves generally, the department consented to the transfer to the Russian Government of the vessels that would be really effective in combatting the ice conditions in the River St. Lawrence. My present intention is to take such steps as may be necessary to provide equipment that will be reasonably adequate to assist any vessel that may find it necessary to navigate the river after the ice conditions become severe. The representations submitted by you on behalf of the Board of Trade as to the extent to which facilities should be provided will be borne in mind by me in the course of the further consideration that the question will receive."

The Marconi Wireless Company of Canada, Limited, has recently formed a subsidiary company known as Scientific Experimenter, Limited, for the manufacture of a product closely associated to their present activities. This work will be in the character of what might be classed as amateur and experimental telegraph and telephone apparatus, and other lines of practical toys distinctly different from the commercial appliances now being made by the parent company. The Marconi factory will be utilized for the manufacture of the new product, and branches will be established in the leading Canadian cities for the sale and distribution of the amateur apparatus.

At the annual meeting of the Dominion Marine Association held recently at the Windsor Hotel, Montreal, the Hon. C. C. Ballantyne briefly reviewed the activities and achievements of the C.G.M.M. After dwelling on the accomplishments of Canadian yards in the construction of freight vessels, the Minister stated that the department had under consideration the building of several passenger ships for operation by the Government service. If the proposal is adopted, these vessels will be built in Canadian yards and with Canadian material, as far as possible. In addition, it was intimated that this departure might be followed by the construction of naval vessels if a naval policy is decided on.

ST. JOHN, N. B.

A NEW record for St. John, N.B., harbor shipping. On January 12 every deep-water berth was occupied, and eight steamers were in the stream with six anchored outside. The Government is being urged to supply more accommodations for the port. Among the steamers in the harbor on that date were: Hyanthes, Orari, Verentia, New Georgia, Montisfont, Possillipo, Cornish Point, Metagama, Knudson, Ferrara, Lord Dufferin, Chignecto, Dailwen, Holbrook, Fedora, Sardinian, Ciarnmona, Bradavon, Impoco, Dumbridge, Manchester Mariner, Georgia, Batisford, Aspen, Glenspean, Protea, Montezuma and the Willpolo.

The new schooner "Cutty Sark," recently launched in St. John, N.B., sailed on January 9 for Las Palmas in the Canary Islands with 693,576 feet of lumber from Stetson, Cutler & Co., Ltd. She was in command of Captain McBride.

Among the steamers which sailed from St. John on January 12 were the Cunard liner "Verentia" for Avonmouth with a general cargo, and the C.P.O.S. "Metagama" with 275 cabin and 450 steerage passengers, and a general cargo for Liverpool.

The sailings now scheduled for the remainder of the season from St. John, N.B., number ten per week.

The steamer "Polglass Castle" sailed from St. John on January 8 for the United Kingdom with a full cargo of wheat flour.

The steamer Ruby L., of the Bay of Fundy service, was badly damaged by fire on the night of December 16, while lying at a dock in St. John harbor.

The steamer Governor Dingley, of the Eastern Steamship Service, plying on the Boston-St. John route, has gone to New York, where she will be fitted as an oil burner. It is the intention of this company to have its steamers converted into oil burners.

The C.P.O.S. steamer Empress of France arrived in St. John on December 19.

Sydney, Cape Breton, has had a brisk steamer business this season, with many ships putting in there for bunkering.

The steamer Tofuka Maru, which arrived in St. John on December 24, was the first Japanese ship to visit that port. She loaded grain for Greece.

BRITISH COLUMBIA

DURING the past month definite headway was made towards the re-establishment of wooden shipbuilding in British Columbia yards. Although the programme is so far a small one, there are bright prospects that it will be enlarged in the near future. The special shipbuilding delegates which went to Ottawa recently from Victoria, headed by Mayor Porter, returned after having arranged with Federal Government for the loan of 70 per cent. by the Dominion on the cost of building wooden schooners for the lumber trade. Only one company, the British Columbia Shipowners, Ltd., has so far taken advantage of this offer. It will build four schooners at the Cholberg Shipyard, in Victoria, and on completion will operate them in the Pacific lumber-carrying routes.

The British Columbia Shipowners, Ltd., is a new corporation. The directors are: R. P. Butchart, cement magnate and former director of the Imperial Munitions Board shipbuilding programme on the Pacific Coast; Clarence Hoard, president of the Bainbridge Lumber Company; Capt. H. C. Hansen, Norwegian ship operator now living in Victoria; W. Mead, secretary of the Cholberg Shipyard; Capt. M. D. Harbord, of the Riggers' Association; Fred Pemberton and Will Spencer, Victoria businessmen. Mr. Spencer is president of the concern. The company is being formed on unusual lines. In addition to the workmen taking stock, the various departments of ship construction and operation will be handled by concerns which will take out a large proportion of their earnings in stock. For instance, the Vancouver Island Riggers' and Sailmakers' Association has agreed to rig the new Cholberg ships, investing a large amount in the company. The insurance, lumber, metal work, etc., are all being handled in the same way.

Whether the Foundation Company will continue to operate in Victoria is uncertain. A portion of the yards where twenty wooden steamers were built for the French Government has been dismantled. The company is still negotiating with the French Government and private interests for the building of more vessels, but no definite agreement has yet been reached. It is understood that the exchange rates are now the main handicap in connection with French contracts, although the British Government has undertaken to meet the difference.

Contracts for the construction of two 8,100-ton steel steamships have been secured by the firm of John Coughlan & Sons, Vancouver, from the Canadian Government. Keels for these two boats will be laid during the latter part of May. The vessels will be built along the lines of those now on the ways, but they will be equipped for the consumption of oil as well as coal. The vessels built under previous contracts were coal burners.

Colonel A. W. R. Wilby, C.B.E., has been appointed agent of marine at Victoria, succeeding Captain G. E. L. Robertson, who is now superintendent-general of pilotage, with headquarters at Ottawa. Colonel Wilby has been associated with the department for several years, having been appointed district engineer in Victoria in 1912. He was also with the engineering department of the Canadian Pacific Railway for some time. For four years he was overseas with the Canadian army and was made labor commandant at Canadian Corps headquarters.

Captain B. L. Johnson, D.S.O., has been named Superintendent of Pilotage for British Columbia. He arrived in Victoria to undertake his new duties a few days ago. Captain Johnson served with

the Grand Fleet during the war, and for a considerable period was in command of a submarine. Before the war he served on the Grand Trunk Pacific steamers.

Although fast steamship service across the Pacific has been limited to that offered by the Canadian Pacific Ocean Services, Ltd., it is understood that another fast passenger service to the Orient will be expanded in the near future. To its present fleet of steamers the C.P.O.S. will add a third of 22,000 tons, now under construction on the Clyde, and at least two freighters. There will likely be sharp competition, as the Nippon Yusen Kaisha and the Osaka Shoshen Kaisha, as well as the Toyo Kisen Kaisha, which operates between Japan and San Francisco, are planning to put faster boats on the northern run. The N. Y. K. is now building three fast and commodious liners of approximately 30,000 tons each for the Seattle-Hong Kong route. These vesesls will make the trip from Yokohama to Seattle in eight days, as compared with the nine-day record of the present service. The company announces that these will be the largest and fastest liners on the Pacific and that they will be in operation early this year. The Japanese company is also understood to have arranged for 100,000 additional tons of shipping, most of the vessels to be cargo-carriers.

After three and a half years of litigation the British Government has handed back to her owners the auxiliary schooner Oregon, with sufficient compensation to put the vessel in seaworthy condition. To Linga & Company, owners of the cargo, goes the money realized by the sale of the freight when the ship was seized in April, 1916, by the Canadian cruiser Rainbow, off the Mexican coast. Interest that has accrued is also to be paid over. The schooner will return to the Mexican coastal trade as soon as she is repaired. The fate of the Leonor, seized as a prize of war about the same time, will be determined by the London Prize Court shortly.

Canadian shipyards are to be kept busy and the industry in this country stimulated at the expense of yards in the United States, owing to the more liberal shipping laws of Canada and the more enlightened policy pursued by the Government towards the industry, in the opinion of Newman Erb, New York railroad magnate, who heads the syndicate of capitalists which now controls the Prince Rupert Drydock and Shipbuilding Company. Two steel ships are now in course of construction at the Prince Rupert plant.

Tentative plans for the three proposed steamers for the Canadian National Railway system have been prepared and are now understood to have been submitted to the Dominion Government authorities for approval. No definite plan has been arrived at yet in connection with the dockage and terminal plans of the C. N. R. at Vancouver, but one of the proposals provides for the utilization of Granville Island for the docks that will be required for the coastwise service. Another is the prospect of using the Grand Trunk Pacific's dock on Burrard Inlet. There is a strong probability of the Government taking over the G. T. P. system and the combination of the C. N. R. and G. T. P. for coastwise operations would then be a logical move.

Although several conferences were held during the past few days, at the time of writing no definite agreement has been reached as regards future remuneration of British Columbia pilots or changes in the working conditions.

Despite the recent slight improvement in ocean trade, the shipping situation in Japan has again become gloomy, chiefly owing to the great decline in the value of the pound sterling and the labor troubles in the United States. The strike of the American coal miners has brought a number of Japanese steamships to a standstill in American ports. Another cause of disappointment to shipping men is the hitch in the negotiations for the chartering of Japanese ships to be used for the repatriation of the Austra-German prisoners in Japan and China, and the Czecho-Slovaks in Siberia. Over a dozen steamers of medium size have been chartered by the Nippon Yusen Kaisha and the Osaka Shoshen Kaisha for the Indian service, but this has had no effect in offsetting the other depressing circumstances. The Indian trade is active and profitable, largely due to the increased demand for Indian cotton since the rise in price of American grades and the low output of Chinese cotton.

In the estimates for the next fiscal year the Japanese Government will probably set aside more than $500,000 as subsidy for two shipping lines to South America to help promote Japan's trade with that part of the world. There was little of this trade before the war, but the disruption of the world's trade, due to the outbreak of hostilities, led to a sudden increase in Japan-South America business, especially in exports from Japan. The Nippon Yusek Kaisha and the Osaka Shoshen Kaisha will probably benefit from the subsidy.

The Osaka Shoshen Kaisha, which ranks second to the Nippon Yusek Company among Japanese shipping corporations, has doubled its capital to $50,000,000. The dividends for the past year were 40 per cent.

THE WORLD'S LARGEST MOTOR SHIP

The motor ship progresses by leaps and bounds. There are now on order about twelve of 13,000 tons deadweight. Four of these are being built in Great Britain and the rest on the Continent. The latest and largest vessel of this type yet launched is the "Afrika," built for the East Asiatic Co. She is 445 feet long between perpendiculars, 60 feet moulded breadth, and 42 feet moulded depth. The engine installation consists of two standard four-cycle Burmeister & Wain, having a combined horsepower of 4,500 indicated. They are of the six-cylinder type, having a bore of 750 mm., stroke of 1,150 mm., and run at 115 r.p.m. The machinery is not so powerful as that of the "Glenapp," built on the Clyde, where two engines of 3,200 i.h.p. each were installed. The Afrika's engines will give her a speed of about 11½ knots, which is the standard speed of the East Asiatic Company's motor fleet. She is essentially a cargo vessel, but will have accommodation for a few passengers. The auxiliary machinery is all electrically driven, the current being supplied by generators, direct-driven by four-cycle high-speed Diesel engines. The 13,000-ton vessels now building on the Clyde will be similar to the "Afrika" but equipped with higher-powered engines, giving them at speed of 13 to 14 knots.

A NEW AND POWERFUL DESTROYER

Messrs. J. Samuel White & Co., Ltd., the well-known shipbuilders and engineers of East Cowes, Isle of Wight, completed and delivered their 120th steel war vessel and 72nd steel torpedo craft on December 23rd. This was H.M.S. "Wivern," the most modern, most powerful and most up-to-date type of destroyer in existence. Of the improved "W" class, she was laid down on August 19, 1918, and launched on April 15, 1919, and is a similar vessel in every way to H.M. ships "Witherington," "Winchester," "Winchelsea," "Vortigern" and "Vectis," also built by the firm, and now serving in the Royal Navy. She is of 1.450 tons displacement and 28,000 S.H.P.

Her full power trials off the south coast of the Isle of Wight were entirely satisfactory, when she attained an average speed of between 34 and 35 konts.

The "Wivern's" twin screws are driven by a double set of Brown-Curtis geared turbines made by Messrs. White, and Mitchell thrust blocks have been installed. Steam is generated in three White-Forster water-tube boilers, each developing over 9,000 shaft horse-power. These, together with the oil fuel-burning installations, all auxiliary machinery, and the entire equipment have also been constructed in the firm's engine works. The ship is capable of carrying some 400 tons of oil fuel, which will enable her to run about 1,000 miles at full speed. Like the other destroyers of her class, the "Wivern's" armament consists of superimposed 4.7 in. guns fore and aft, with fire control and director gear; two anti-aircraft high-angle quick-firing guns on an elevated platform amidships, and two sets of triple torpedo tubes mounted on revolving platforms.

As is customary with all White-built destroyers, the living accommodation for officers and crew surpasses that of most destroyers, the firm having consistently made this a special feature of their construction The name "Wivern" has hitherto been borne by but one ship of the British Navy, an armored turret coast defence ship of 2,750 tons, 1,000 horsepower and 4 guns. She was built by John Laird at Birkenhead in 1862-1863 for the Confederated States, but was purchased into the Royal Navy in 1865, and eventually sent to Hong Kong, where she ended her career a few years ago.

The Modern Cruiser Stern is Described

In an Interesting Paper Read Before the Institute of Engineers and Shipbuilders in Scotland. A. Hillhouse Describes the Cruiser Stern

By P. A. HILLHOUSE, B.Sc. [November 25, 1919]

AS THE application of the cruiser stern to mercantile vessels has apparently "come to stay," I trust that a short discussion of its history, features, and merits or demerits, may be of interest to our shipbuilding and shipowning members.

The first large liners to have the cruiser stern were the "Empress of Russia" and the "Empress of Asia," built in 1913, although the coasting steamers "Prince Rupert" and "Prince George" had been so constructed in 1910, and the Wilson liner "Borodino" in 1911. The Empresses were followed by the Allan liners "Calgarian" and "Alsatian," and the fashion spread so rapidly that Lloyd's Register now contains the names of over 150 vessels followed by the caption "Cruiser Stern."

The early merchant vessels had but a small extension of the deck beyond the sternpost, designed probably with the object of housing the rudder stock, and affording space and protection for the tiller and steersman. This projection being found both convenient and sightly, gradually increased in extent until the ordinary "overhanging counter," "elliptical," or "armchair" stern became, and remained for many years, the standard practice in mercantile design. The taffrail of the "Britannia," the first Cunarder, overhung the sternpost by about eight feet; the "Britannic" had a projection of 32 feet.

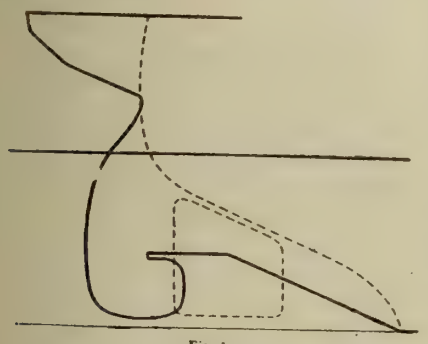


Fig 1a.

Naval vessels developed in quite a different fashion. In order to reduce weight and target as much as possible, war vessels had usually much less freeboard than their mercantile contemporaries; their decks aft were much nearer to the water-line, and as it was known that length of water-line was favorable to speed, the underwater body was extended as far as possible aft of the sternpost, forming an immersed counter or cruiser stern. This immersion of the counter which really gave to the designer a working length considerably in excess of the nominal length — was, in fact, a kind of innocent deception which deceived nobody. There was no valid reason beyond custom, sentiment, and inertia to prevent the same principle being applied to merchant vessels, and as soon as the "elliptical stern" tradition had been boldly broken, and the advantages of immersing the counter fully realized, the new stern made rapid progress, and is now in a fair way to become universal. The projection was there. 20 or 30 feet of it, and the vessel was occupying just so much more quay and canting space than her nominal length. The cruiser stern merely makes water-line length equal to over-all length, and utilizes the whole length of the vessel for displacement and propulsive purposes. The change from overhung to immersed counter may be regarded either as cutting off an unnecessary excrescence, and bringing the rudder further forward (Fig. 1a), or as an extension of the ordinary overhang downward to and below the water-line (Fig. 1b).

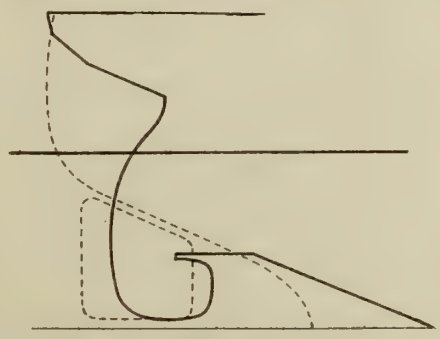


Fig. 1b.

As an example of the advantage obtained by the adoption of a cruiser stern, I present the case of a twin-screw passenger and cargo vessel, 550 feet in length, in which it is desired to carry 2,800 tons of cargo in addition to passengers, stores and water, and fuel for a voyage of 3,000 miles, at a mean speed of 18 knots.

The particulars of such a vessel, if constructed with the ordinary overhung counter, would be approximately as follows:

	Feet
Length between perpendiculars	550
Length over all	570
Length on water-line	550
	Tons
Weight of hull	11,200
Weight of machinery	2,800
	Tons
Light weight	14,000
	Tons
Fuel for 3,000 miles	1,970
Fuel, 2 days spare	570
Fuel, use in port	160
Total fuel	2,700
Passengers, stores, water	1,500
Cargo	2,800
Total deadweight	7,000
Load displacement	21,000
Load draught (moulded)	28 ft.
Load block coefficient	·682
Deduct half fuel consumption	985
Displacement half-way	20,015
Draught molded half-way	26 ft. 10½ in.
Block coefficient half-way	·677
Mean speed	18 knots
Speed-length ratio, $V \div \sqrt{L}$	·768
Horse-power	17,650
Admiralty coefficient	254

If now the ordinary overhung counter be replaced by a cruiser stern, the counter being well immersed so that both the water-line and the curve of cross-sectional areas can be carried out fairly to the end of the stern, it will be possible to add about 20 feet to the effective length of the ship. The speed-length ratio and the block coefficient can both be correspondingly reduced, with a consequent decrease in horse-power. This saving in power enables one in turn to cut down the weights of machinery and fuel, and so to fine the form still further and save more power. This process can be repeated until at last a balance is reached at the point where the displacement necessary to carry all the required weights is just the displacement which can be driven at 18 knots by the power installed. We then have:

	Feet
Nominal length	550
Length over all	570
Length on water-line	570
Breadth moulded	70
Depth to bridge deck	54
	Tons
Weight of hull	11,200
Weight of machinery	2,575
	Tons
Light weight	13,775
	Tons
Fuel, 3,000 miles	1,750
Fuel, 2 days spare	505
Fuel, use in port	160
Total fuel	2,415
Passengers, stores, water	1,500
Cargo	2,800
Total deadweight	6,715
Load displacement	20,490
Load draught (moulded)	28 feet
Load block coefficient	·642
Deduct half fuel consumption	875
Displacement half-way	19,615
Draught moulded half-way	27 feet
Block coefficient	·637
Mean speed	18 knots
Speed-length ratio, $V \div \sqrt{L}$	·755
Horse-power	15,675
Admiralty coefficient	272

In the above it is assumed that any consumption of stores, domestic water and reserve feed-water is compensated for by the addition of salt water ballast for the maintenance of stability and trim, so that the only reduction of displacement that can be taken advantage of is that due to consumption of fuel.

It will be seen that the adoption of the cruiser stern has resulted in a saving of nearly 2,000 horse-power and of 220 tons of fuel per trip, or about 11 per cent.

The area of the upper deck will be increased in proportion to its extra length, as the effect of the lesser block coefficient will hardly be felt in the upper works; the water-line area will be the same in either ship, while the space available for the stowage of cargo will be practically identical in the two vessels, since the capacity lost on account of the fining of the extremities of the cruiser-stern vessel will be compensated for by the lesser volume occupied by machinery and fuel.

On a shorter trip, from port to port, the economies would not be so great, since the saving in weight of fuel would be less; on a longer voyage still more favorable results could be realized.

The swift cross-channel steamer presents a somewhat different problem, as in this case the total fuel consumption is small, and the block coefficient is probably already at its optimum value. In such vessels, however, the "M" value or ratio of length to cube root of displacement is of great importance, and the increase in this factor obtainable by the addition of even a few feet to the water-line length will, in combination with the reduction in speed-length ratio, have a favorable effect upon propulsion.

Although the immersed counter form applied to merchant steamers is conveniently referred to as a cruiser stern, yet in reality the merchant cruiser stern and the naval cruiser stern are very dissimilar in appearance. The single common factor is that of the immersion of the counter, and this is, of course, the *raison d'être* of this type of ending. In the warships, however, the deck at which the top of the stern profile ends is much nearer to the water-line, and of very much finer form than in the case of the merchant vessel. The mercantile owner is accustomed to a deck ending in a very full so-called "elliptical" curve, a shown by the line A in Fig. 2, and if offered a smaller area in the form of line B, he is apt to feel that he is being defrauded, and to ask why the builder proposes to cut away so much of his deck area aft. The ship is probably built to the fuller deck line, and it thus becomes difficult to make the merchant cruiser stern a thing of beauty, as the bulging deck plan does not harmonize well with the necessarily fine ending to the water-line. This want of harmony becomes accentuated if the profile of the stern "tumbles" forward, as in Fig. 3, and such a contour, if associated with a full deck line, is apt to produce a stern giving the impression that it had been forcibly bumped forward at the top, and that the sides had bulged outward in consequence of the blow. A more harmonious appearance can be obtained by tumbling the contour aft, as in Fig. 4, and line C, in Fig. 2, and fining the deck line, although in this case some of the over-all length is again devoted to appearance and not to useful immersion, and the owner will probably still be averse to the fine deck end.

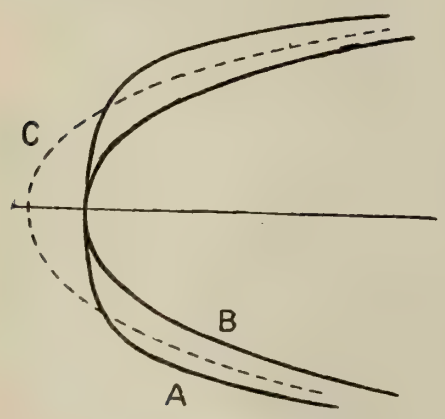


Fig. 2

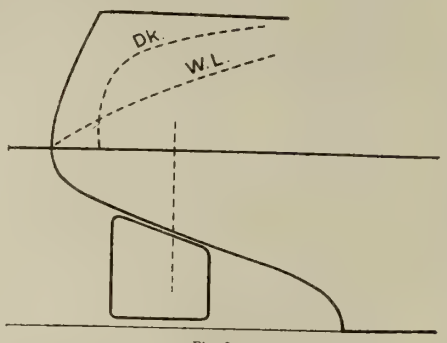


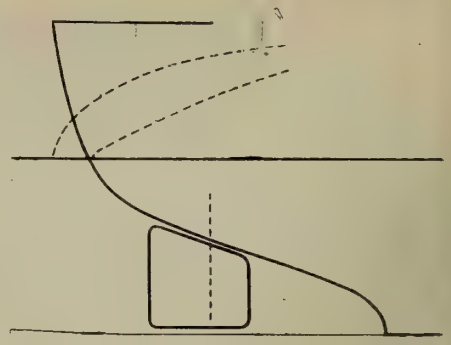
Fig. 3

The earlier merchant cruiser sterns were associated with the small propellers of direct turbine drives, and no trouble was experienced in satisfactorily housing the propellers within the half-breadth of the ship.

Fig. 5 compares the cross sections in way of the propellers for a vessel with ordinary stern and reciprocating engines, and for a vessel with cruiser stern and direct turbines. In both cases the deck projects beyond the propellers, although in the case of the ordinary stern the protection obtained is more imaginary than real, since the deck edge is so high up that quay walls or barges may easily come into contact with the propeller without touching the deck.

But the progress of marine engineering has rendered the direct drive almost obsolete for merchant work, and standard practice is now to fit either single-reduction or double-reduction geared turbines. The larger propellers so obtained are much more efficient, but it is much more difficult to place them satisfactorily abreast of the cross sections of the cruiser form of stern, and it appears probable that the cruiser stern might never have been adopted for merchant work had its introduction not been facilitated by the small size of the propellers prevalent at the time.

To obtain full advantage of the immersion of the counter it is desirable that both the water-line and the curve of cross-sectional areas should be carried without hollow or "tail" right out to the end of the stern profile. With the ordinary stern the propellers were usually placed a few feet forward of the stern-post from which the water-line and area curve begin (Fig. 6), and were thus associated with very small transverse ship dimensions.



In the case of the cruiser stern, however, the propeller is further forward in relation to the beginning of the area curve (Fig 7), and so comes abreast of a much larger cross-section and it is consequently more difficult to house it satisfactorily. Baker, in the excellent paper he read before this Institution last February, pointed out that it is desirable to keep the final angle of run of the water-line to about 20 degrees, and in any case to not more than 25 degrees, from the middle line. We are thus faced with the difficulty of obtaining in way of propellers a cross section having a narrow water-line (to work in the 20 degrees angle), a large area (to avoid hollow in the curve of areas), and a wide deck (to please the owner and to protect the propeller). A full rounded section (Fig. 8) will give deck breadth and area, but not the 20 degrees water-line. A more vertical section (Fig. 9) will give the desired water-line and curve of areas, but not the deck breadth. In this case the profile would probably have to be tumbled forward and the deck line made very fine. Fig. 10 gives the broad deck and fine water-line, but necessitates a hollow in the curve of areas. To obtain all three desiderata we are apparently forced to make the cross section abreast of the propeller practically straight, as

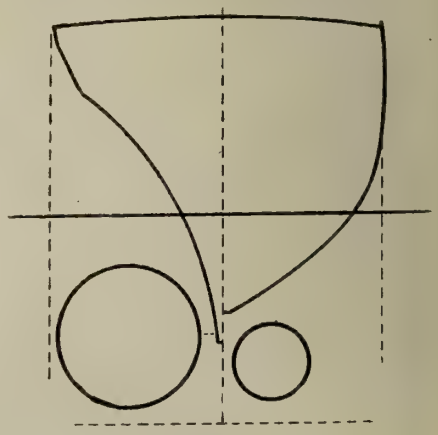


Fig. 5

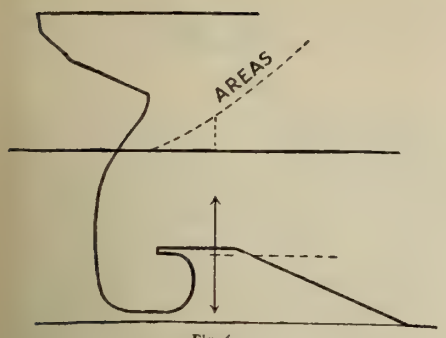


Fig. 6.

in Fig. 11, at the same time placing propeller and rudder as far aft as possible, and so obtaining the profile shown by Fig. 12.

Many advantages have been claimed for the cruiser stern in addition to its beneficial effect upon propulsion, and without pressing any of such claims too far, I think it can fairly be stated, as regards cost, strength, stability, seaworthiness and absence of vibration, the new form is at least as good as its predecessor.

Discussion

Mr. W. H. RIDDLESWORTH, M.Sc., M Eng. (Associate Member): The subject of this paper is one in which I have tak-

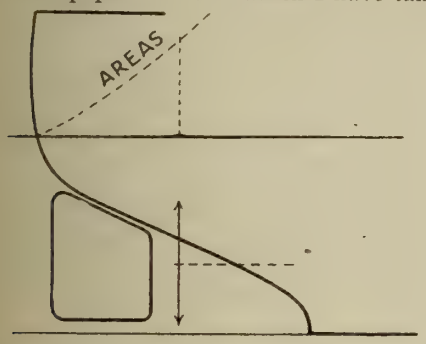
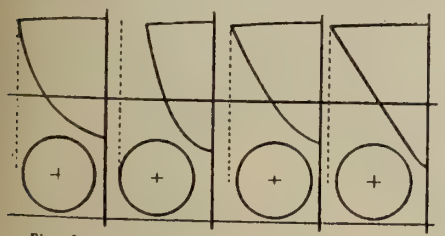


Fig. 7.

en a considerable amount of interest for many years. Referring to the historical review in the second paragraph of the paper and Mr. Hillhouse's remarks "That the cruiser stern might never have been adopted for merchant ships had its introduction not been facilitated by the small size of the propeller prevalent at the time," I may add that about 20 years ago an attempt was made to design a cruiser stern for a merchant ship with the then existing type of propeller. A considerable amount of time was spent over the matter, and a great deal of thought given to it, but eventually it had to be abandoned. It was found impossible to work in anything like the existing deck area or anything like the existing propellers, and to extend the under-water body of the ship as far as was required.

I should be glad if Mr. Hillhouse would add a little information to the third paragraph of his paper regarding the comparison of the length of the counter. As it stands, it looks as if one vessel had four times as much counter as the other. It would be an advantage to state the percentage of length in each case. If the counter outline of the one ship were superimposed on that of the other, it might be found that the difference was not very great. I am not in accordance with Mr. Hillhouse when he says "This immersion of the counter which really gave to the designer a working length considerably in excess of the nominal length — was, in fact, a kind of innocent deception which deceived nobody." I think in a way it deceived everybody. To take one point only, upon which a great many other things hang, the question of the strength of the vessel — it will be admitted that the principal stress to which the structure of the ship is subjected is due to the support given to the weight of the ship by the water, and of the features of that support the most important, as regards bending-moment, is the length. Referring to the example in the body of the paper, in the one case the weight is supported by the pressure of water spread over 550 feet, and in the over over 570 feet; this must necessarily give different values to the bending-moment, and it is my opinion that almost all stress investigations that have been made on ships with cruiser sterns have been subject to this confusion, and that persons have been deceived because the nominal length only was used. In that way I think the deception was not innocent, and, more than that, the Registration Societies which regulate scantlings of merchant ships were deceived for some time. The scantlings of a ship which depend upon the length where regulated by the distance from the fore side of the stem to the centre of the rudder stock, and the position of the centre of the rudder stock, bore no definite relation to the length over which the supporting forces were applied to the ship. It dawned upon them later that they were being deceived, and they made a rule that the length to be taken for regulating scantlings was not to be less than 96 per cent. of the actual immersed length, or the over-all length, as the case might be. That raises the question of what is the proper allowance of weight for two ships which have the same over-all length, one with a cruiser stern and the other of ordinary form — a very important and complicated matter with which I do not propose to deal, rather leaving it for some other member to consider.



Figs 8. 9. 10. 11.

Mr. ANDREW HAMILTON (Member): Having had to do with a good many cruiser-sterned cargo steamers, I consider the cruiser stern an advantage. One may have a belief in a thing, but at times it is impossible to confirm that belief on account of the difficulty of acquiring exact data. In Fig. 13 the full line shows a cruiser stern, whilst the broken line represents the ordinary stern, both in elevation and plan of load water-line.

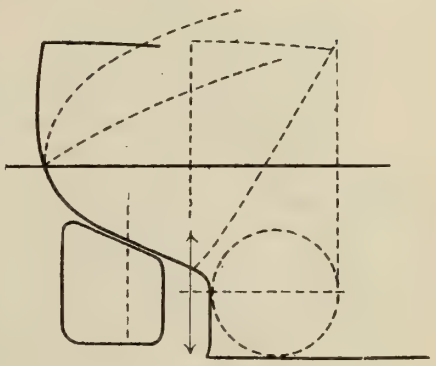


Fig. 12.

A B indicates the position of the rudder post where the ordinary water-line finishes, as shown by the broken line. The full line of the cruiser stern gives a better water-line, and in a 470-foot vessel something like from 24 to 28 feet width will be obtained at the position A B, instead of the water-lines ending there. I refer to vessels having a single propeller of about 18 feet diameter, where the fuller water-line does not obtain until a draught of over 20 feet is reached, the draught increasing up to, say, 27 feet, giving 7 feet of cruiser stern immersed at the load condition. In a 470-foot single-screw ship, the cruiser stern gives about 4,000 cubic feet more space than the ordinary stern in a vessel of the same over-all length.

Tank model experiments were made on models of these types, with ordinary and cruiser sterns respectively, and it was found that the full-lined form took about 2½ per cent. less horse-power to drive it at a speed corresponding to 12 knots for the ship. The ships were each 470 feet long, both having turbine machinery, and, taking the results of working during two years, the ship with the cruiser stern appeared to be about 2¼ per cent. better than the other. It is very difficult to say in actual practice that one is geting a great improvement, but the cruiser stern gives extra space with no extra power, and when the ship is loaded a considerable part of the weight of stern is water-borne, giving equally as seaworthy a boat, and, in my opinion, it is worth the extra cost of fitting. I quite agree that with the cruiser stern, twin screws should give better results than a single propeller. The cruiser stern has come to stay because of its definite advantages, and time only is required to overcome the prejudice to change.

Mr. G. S. BAKER, O. B. E.: Mr. Hillhouse's paper is really confined to the consideration of the propulsion effect of a cruiser stern on vessels of one type doing about 18 knots on 550 feet length. Generally speaking for this class of vessel, there is little doubt that the cruiser stern can be made of considerable advantage in reducing resistance, and therefore coal consumption. Toward the end of the paper Mr. Hillhouse points out the difficulty of lining out these sterns without filling out the water-line beyond the 25 degrees mentioned in the paper by Mr. Kent and myself, read before the Institution last February. This angle

was fixed by us for cargo-boat forms with the ordinary raised counter, and although we have no concise data to go on, my opinion is that it could be increased with advantage for cruiser sterns if the vessel is really hard up for length as regards wave making. It has to be remembered that a *very* full load waterline aft may tend to give transverse sections with a lot of hollow in them just about, or a little forward of the propeller, and greater clearance between propeller tip and hull would then be necessary to get the best result with the propeller, as this is not likely to improve in efficiency if the flow to it is restricted by the form of ship.

Cruiser sterns have been adopted in a number of relatively slower vessels than those considered in the paper, but for such vessels their effect on propulsive

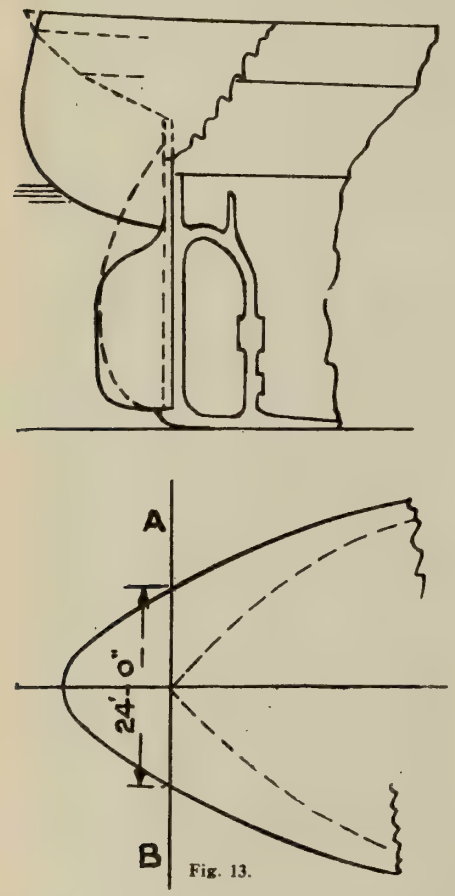


Fig. 13.

efficiency is rather different. In such vessels the object is to eliminate eddy-making on the upper levels, and although improvement in wave-making may also result, the former is the chief thing considered. In these boats the propulsive advantage of a cruiser stern is never very great — not nearly so much as that for the faster vessel dealt with in the paper — and its adoption has been largely due to considerations apart from simple propulsion. It may be of interest to record that the first vessel of this type with a cruiser stern was tested in the Froude tank in July, 1913.

Mr. JOHN ANDERSON: I think we all know that Mr. Hillhouse has tried many types of sterns on the vessels he has designed, and I presume, from the figures given in the paper, that he considers the cruiser stern gives better results than any of the earlier types of stern.

No doubt Mr. Hillhouse has chosen the faster type of vessel for his example because it illustrates most markedly the advantages he states, and, although he has given a great deal of information, I think the paper would have been even more valuable if he had also touched on the application of the cruiser stern to the slower type of vessel to which such sterns are now very often fitted — I refer particularly to slow cargo vessels. It seems to me (especially for single-screw vessels on which it would generally be out of water) that that type of stern would never satisfactorily replace the elliptical stern which has been in vogue in the past. I would like to ask Mr. Hillhouse his opinion of the cruiser type of stern for fast vessels, say for cross-channel steamers — compared with the design which has generally been followed. I refer to the design of the form in which the lines of the hull are carried aft to the back of the line of the rudder, as in the accompanying figure. With such a design it seems to me that he might be able to meet more easily Mr. Baker's ideals as to form, and, I believe, give some increase in hull efficiency.

I am not prepared to make any definite statement regarding hull efficiency, but, from the analysis I have made of the results given by several vessels with cruiser sterns, and with the limited

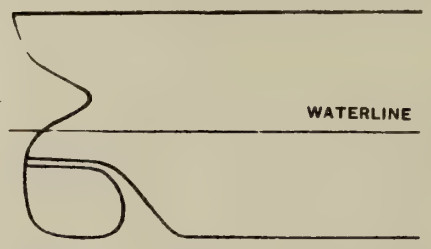


Fig. 14.

amount of data and facilities for analysis at my disposal, I came to the conclusion that there was a very distinct drop in this figure associated with cruiser sterns. Perhaps that was due to these vessels being very broad on the waterline in way of the propellers, and to the propellers being so far forward on the termination of the form.

I would like to ask Mr. Hillhouse if he has considered the additional initial cost of fitting a cruiser stern to a vessel? It is necessary to adopt a very expensive type of rudder, and a considerable amount of extra steel is required. It appears to me possible, as an alternative, particularly in the slower types of vessels, to utilize some of this additional cost and weight by increasing the beam slightly instead of fitting the cruiser stern; in that way a finer model would also be obtained, and, in conjunction with the alternative type of stern to which I have referred, one would probably obtain as economical a result in propulsion as Mr. Hillhouse has suggested. With such a redistribution as this a great addition would be made to the cargo and passenger space in the middle (and best) portion of the vessel, as compared with that yielded by a cruiser stern.

Recognizing that direct steamship connections between Canada and the British West Indies is one of the chief necessities for the development of export trade, the Montreal Board of Trade, at a recent meeting, unanimously decided to consider the question of confederation of the islands with the Dominion. While expressing satisfaction with the great improvement made in steamship service by the vessels of the National Marine Service, the members felt that even the present efficient service is entirely inadequate to the existing and early future requirements, both as to freight and passenger traffic. A committee of prominent Montreal business men are leaving on a business trip to the West Indies, and they have been authorized to take up the question of closer political relations with the Chamber of Commerce in the islands.

At a recent meeting of the Montreal Chambre of Commerce, Lieut.-Col. Hercule Barre, newly-appointed Canadian Commissioner to Paris, emphasized the importance of Canada's commercial representation in many parts of the world, portending a new era of development and prosperity for Canadian trade. He remarked on the lack of definite information that the Department of Commerce at Ottawa had in respect to Quebec industries and commercial activities, adding that he did not blame the Government so much as the business men of the province in not giving to the department the necessary information.

The increasing trade that is constantly developing between Canada and overseas countries has resulted in the Government taking greater interest in th facilities of the ocean terminals that will be called upon to take care of this expanding traffic. There is every possibility that the port of St. John, N.B., will be slated for extensive improvements and additions in the very near future as Government representatives recognize the importance of this nerve centre of the inter-Continental trade system. Speaking on this subject recently, A. P. Barnhill, K.C., one of the directors of the C.N.R., said: "The important matter now for the city of St. John is not so much the railroad service as terminal facilities for ocean business. The railroad service is here but we still lack facilities for increasing ocean business that will soon come here. In answer to my representations that St. John is entitled to consideration in the allotment of steamers equal to that given to any other port, the fear has been expressed that there will be congestion at this port. That is, the facilities are not adequate for the steamships which are scheduled to arrive here. It is apparent that these facilities must be greatly increased at once to take care of the business of the immediate future."

PROGRESS IN NEW EQUIPMENT

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"VOLYUM" CENTRIFUGAL PUMP

The Volyum Pump Co., 419 West Liberty St., Cincinnati, Ohio, have brought out a new vertical centrifugal pump, known by the trade name of "Volyum" and intended especially for supplying the coolant for machine or cutting tools. Fig. 1 shows an outside view of the device, while Fig. 2 is a sectional view showing the construction. The impeller is of the open type, mounted on the lower end of the vertical shaft and extending the full depth of the semi-spherical body, there being no contact between the impeller and the body casting. The bearings for the impeller shaft are both above the water line; one of these bearings is formed by the stuffing-box gland that is located just above the impeller, while the second one is in the cap. The drive from the pulley is through two spiral gears, placed at right angles and having a 3 to 1 ratio. The large gear is mounted on the driving shaft and runs in oil in the chamber formed by the cover, this oil serving to lubricate both the shafts and the thrust bearings, as well as the gear teeth themselves. A 3-in. flanged pulley is standard equipment, although a gear or sprocket wheel can be substituted if desired. The pump can be mounted on either the side or end of a machine, as desired, various angles of drive being obtained by swiveling the cover in relation to the body and by reversing the position of the pulley. In order to eliminate the loss of the liquid necessary for priming, the suction pipe is located above the delivery box and the body thus retains a full supply of liquid. The pump is at present made for ¾-in. pipe connections, and has a capacity of from 5 to 22 gal. per minute, depending upon the speed.

THE G. T. D. GUN TAP

Whether you shave yourself or go to the barber, you know that no matter how clean the razor is it is bound to scrape and pull unless it is held on an angle so as to give a shearing or slicing stroke. Application of this principle to the field of mechanics has been common — witness the lawn-mower blade and the scissors, but up to the advent of the G. T. D. "Gun" Tap none of the attempts to apply it to internal threading had been commercially successful.

Recognizing the advantages of the shearing cut, the Greenfield Tap and Die Corporation, Greenfield, Mass., set about the solution of this elusive problem, and after many experiments succeeded in perfecting a tap incorporating this principle.

The secret of this tap's phenomenal success lies in its radically different design. The cutting edges at the point of the tap are ground at an angle to the axis for a distance of three or four threads. This angle in conjunction with the extraordinary hook of the land and special flute form, produces a long curling chip similar to that of a well-ground lathe tool. This chip is not passed out through the flute, as in the ordinary tap, but shoots out ahead of the tool as it progresses; hence the name, "Gun" Top.

Owing to the fact that the flutes are not required for the passage of chips, they are made comparatively shallow, leaving a very large cross-sectional area. In fact there is as much metal in the threaded section as in the shank. This accounts for the exceptional strength of the tap. All of the cutting is done by the first few teeth; the rest of the thread acting as a lead screw, steadies the tap and produces very accurate work.

The angular cutting edge with its pronounced hook shears the metal instead of tearing it off with a full face-on scrape. This shearing action completes the work with half the power required to drive the ordinary tap. Furthermore, it cuts a much cleaner thread in any material, whether it be lead or chrome vanadium steel. Tests run in ten different metals varying from soft to hard have established the fact that the "Gun" Tap will hold its size and lead in any material.

As the grinding is done only on the cutting edges, the tap will cut to size until it is ground down to the last three or four teeth.

The "Gun" Tap is especially adapted to the quantity production of extremely accurate tapped holes. Inasmuch as the chips shoot ahead of the tap, it is imperative in blind hole work to provide sufficient bottom clearance. Otherwise the chips jam into the end of the hole and stop the tap, with disastrous results. A good general rule for blind hole "Gun" Tapping is to make the clearance equal one quarter the depth of the hole. While this necessitates a little extra work for the drill, it is more than compensated for by the increased speed and accuracy of which the "Gun" Tap is capable.

For blind hole work under the above conditions, or for all open hole tapping, the "Gun" Tap is unexcelled.

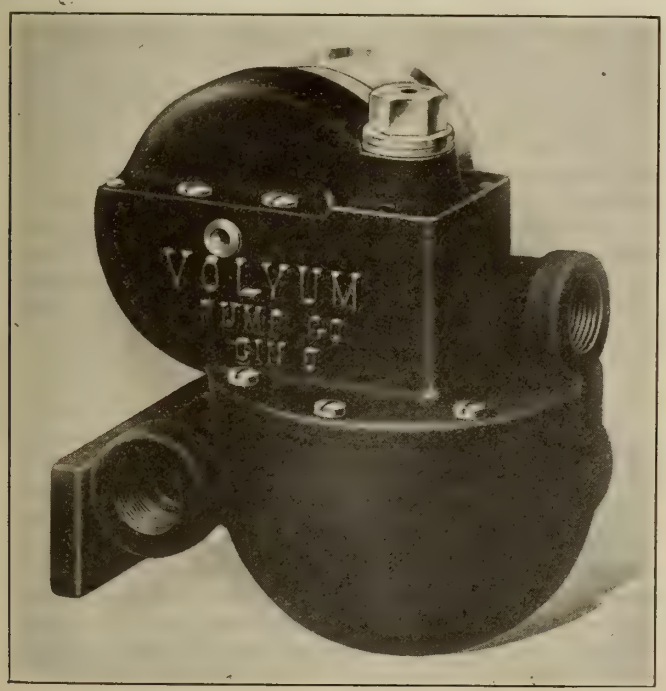

FIG. 1—OUTSIDE APPEARANCE OF PUMP.

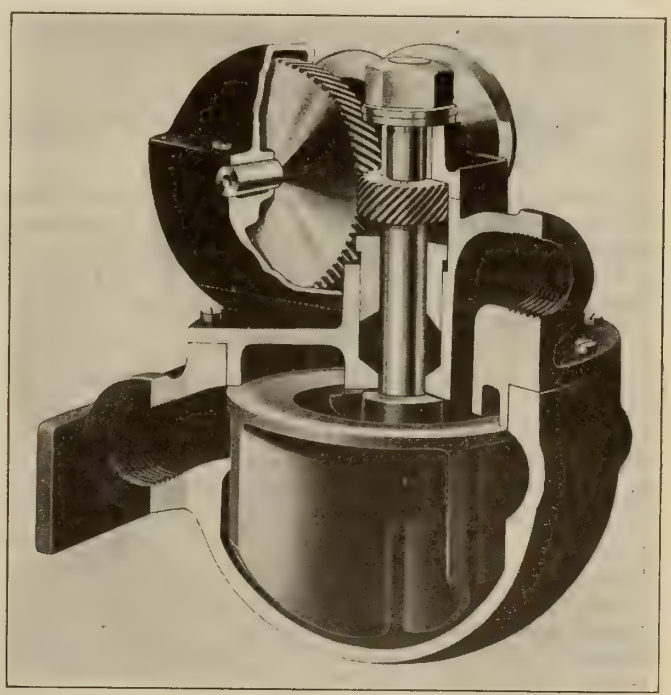

FIG. 2—SECTIONAL VIEW OF PUMP

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LIMITED

(ESTABLISHED 1887)

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PUBLISHERS OF

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A monthly journal dealing with the progress and development of Merchant and Naval Marine Engineering, Shipbuilding, the building of Harbors and Docks, and containing a record of the latest and best practice throughout the Sea-going World.

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The Future Mechanics

It is a significant fact that the Grand Trunk Railway Company, after a trial of the four-year term for apprentices, is going back to the five-year term. This is the best possible proof of the assertion so often made, that a mechanic cannot be made in four years. If this is true in the railway shop, is it not equally so in the marine engine shop, or the general engineering shop? There are two sides to engineering, the trade and the profession, and the man who aspires to call himself an engineer tradesman, must be something more than a machinist. In fact it is better for him to have just a general knowledge of the various machines, and a more detailed knowledge of the fitting and erecting, with some of experience in operating. He should have opportunities to work on general repair work, to learn the principles of overhauling. There are many excellent machinists who can make parts for an engine or machine to very exact dimensions, but have no idea of how these parts should be fitted, or how they function. The engineer tradesman should know the use of every part in the main engines and auxiliary machinery, how to adjust them, and how to keep them operating. It is from the ranks of the apprentice engineers that the seagoing marine engineers are recruited, and it is a noted fact that nearly all the leading British engineers have served a number of years in the shop, and afterwards served at sea. However, much may be added to their education during or after the apprentice period, of a technical nature, the fundamentals can be learned only in the workshop. The United States are making marine engineers out of stationary engineers, fireman and oilers, by intensive instruction. Of course, with such supermen as the citizens of the United States admit themselves to be, this may be possible. However, if we had to man a ship's engine room, and said ship was going to be away from the home port for from one to three years, we would not pick any products of intensive training. The men who earned for the "Olympic" the name of "Old Reliable" were men who had put their five years' apprenticeship in, coupled with technical training, and a considerable period of sea service before attaining a senior position. The "Olympic" was probably the best known example, but hundreds of British ships went on for the whole period of the war without any general overhaul, and it was not the skill of the captain and deck officers that kept them going. It was the engineers. The lesson for Canada is obvious. If she wants to develop a merchant marine, she must develop the men to run it. Encourage the apprentice, and give him every chance to be at the end of his term a mechanic in the true sense of the word. With that ground work, he will go to sea and develop into the perfect marine engineer, with all the high traditions of the calling. It is the highly trained personnel that Britain possesses in her mercantile marine that is going to be one of the greatest factors in meeting future strong competition. Canada should develop the same, and it is time to start.

Inaccuracy in Reports

WHILE the average technical article is reliable, and great care is taken to make it so both by the author and the editorial staff of the paper in which it appears, still occasionally someone slips up and an error or false statement palpably inaccurate creeps in. We are referring to a recently-published statement in connection with radiation loss. The point at issue is in the figure of 502° appearing on a chart as the temperature of the exterior wall of the setting. This is pretty warm.

Building up the Liner Fleet

REPORTS from England tell of the launching of two purely passenger liners, one for the fleet of the Pacific Steam Navigation Company, and one for the Anchor Line. These vessels are noteworthy for the fact that they are the first vessels built since the war of the purely liner type. By this it is not meant to convey that they are of the New York route class, but they are designed as liners, and not cargo boats. They also tend to illustrate the lines upon which the replenishing of the passenger fleets of Great Britain will be carried out. The luxurious fast passenger vessel of the "Lusitania" and "Aquitania" class will not be built in the immediate future. The need is for the intermediate type of passenger boat, with a moderate speed of 17 to 18 knots, having ample passenger accommodation, coupled with a relatively large carrying capacity. They will be economical of fuel, and in many cases, in fact, the majority, will be fitted to burn oil fuel. The propelling machinery will be geared turbines. Many of the existing ships of the large passenger lines are being converted from coal burners to oil burners, the greatest of all being the "Aquitania," which is being altered and reconditioned at the yards of Armstrong, Whitworth on the Tyne. The Cunard, Anchor, Anchor-Donaldson, and Anchor-Brocklebank lines are building between them 34 ships, aggregating about 400,000 tons, every one of which will be oil burning, and geared turbine driven. While standardization, as it was understood during the war, cannot be applied to these specially-designed ships, shipowners will build numbers of vessels to the same design, thus allowing them to order all the material for a series of ships well in advance, to the same specifications. The building of the liner fleet, which is so much needed to maintain Britain in the forefront of the maritime world, will proceed from now on with speed and regularity, till she is once more in the forefront, where she can be trusted to remain.

Publicity For Canada

THERE has been a great deal of advertising of one kind and another done for Canada, some of which, like the ice palace in Montreal, might have been well dispensed with. The Canadian Pacific Railway has been doing some real constructive advertising in Great Britain lately, which cannot fail to be of value to the Dominion. This has taken the form of illustrated lectures, the illustrations being carried out by a moving picture machine, showing the industries of the country in active operation. The first lecture was given in the Central Hall, Westminster, and the industrial views were preceded by a series of scenic subjects, which practically covered the Dominion. Then a film was shown which covered the paper-making industry, from the cutting of the tree, through the logging road, the drive to the mill boom, the sawing, barking, chipping, cooking, and so on to the finished product. The interest manifested by the audience was intense. Following this came a review of the wool industry, likewise traced from the back of the sheep to the finished cloth. Then came the asbestos mines of Quebec, and it was once more demonstrated that the bulk of the world's asbestos supply was concentrated in that Province. The explanatory lecture was introduced by a speech from Sir George McLaren Brown, European manager of the Canadian Pacific Railway, who emphasized the necessity of cementing the component parts of the Empire together in such a manner that disruption would be impossible. Educative propaganda of this kind is of the utmost benefit to Canada, and should have the effect of inducing the very best kind of immigration. We must have immigration if the great resources of this country are to be developed as they should, and scenes from the actual life of the country are a much better means of persuading the intending settler than the doubtful methods employed in the East by unscrupulous immigration agents.

The Exchange Situation

AMERICAN firms doing business in Canada have made a very fair move to overcome the handicap to their business by opening bank accounts in Canada.

The business going from Canada was being discounted in payments anywhere from eight to eleven per cent.

The way to overcome this was simple. Open a Canadian account, accept Canadian money at par, in the certain knowledge that the tremendous wealth and resources of this country are sufficient to bring the exchange rate back to normal.

Canadian people do not like to have their money sausage-machined in United States or in any other country.

Canadians feel that there is real security behind their coinage, and do not relish the inference that carrying Canadian bills or silver is nursing a white elephant.

U.S. firms that are opening accounts here, and accepting payments of accounts at par are showing in a concrete way that they have confidence in Canada's ability to right the exchange situation.

In other words, they have confidence in the common sense of the Canadian people to see that growing more and producing more is their one sure way out.

They have confidence in the common sense of the Canadian people to see that shutting down on production by shorter hours and less effort is going to be a funeral rather than a festival.

Canadian people enjoy the confidence of these U.S. merchants. It is a compliment to the worth and strength of this country to have an exchange rate of from 8 to 11 per cent. waived in our favor.

Canadian people should come right up to scratch and demonstrate fully that this confidence is well placed.

Production in 1930!

A WRITER, with a rather facetious turn of mind, has a story in a recent number of *Engineering*, in which he describes a motor car being turned out in batches of 10,000 at £50 each. The story is dated 1930, and released for publication now, no doubt, in order that people may hold their automobile orders for the new car.

The manner in which automobile production has been brought to a science, and turning out of parts speeded up to a tremendous rate, also has the tendency to open the door to the writer who sees in this age of specialization the opportunity to lead in the absurd and the ridiculous.

So when the mechanical specialists of the automobile world find writers having their little fling at them and at their work, they will simply have to grin and bear it. Such is fame.

Educational Items for Future Officers

A Series of Questions and Answers on Subjects Pertaining to Seamanship—Rule of the Road—The Use of the Chart—These Articles Will Appear Monthly

Continued from last month's issue.

THE words "prolonged blast" used in this article, shall mean a blast of from 4 to 6 seconds' duration.

A steam vessel shall be provided with an efficient whistle or siren, sounded by steam or some substitute for steam so placed that the sound may not be intercepted by any obstruction, and with an efficient fog-horn, to be sounded by mechanical means, and also with an efficient bell. A sailing vessel of 20 tons gross tonnage or upwards shall be provided with a similar fog-horn and bell. In fog, mist, falling snow, or heavy rain storms, whether by day or night, the signals described in this article shall be used as follows, viz.:

(a) A steam vessel under way, excepting only a steam vessel with a raft in tow, shall sound at intervals of not more than 1 minute, 3 distinct blasts of her whistle.

(b) Every vessel in tow of another vessel shall, at intervals of 1 minute, sound 4 bells on a good and efficient, properly placed bell as follows: By striking the bell twice in quick succession, followed by little longer interval, and then again striking twice in quick succession (as in striking 4 bells to indicate time).

(c) A steam vessel with a raft or a string of booms in tow, shall sound at intervals of not more than 1 minute, a screeching or modoc whistle from 3 to 5 seconds. Only steam vessel with raft or booms in tow shall sound this screeching whistle in thick weather.

(d) A sailing vessel under way shall sound, at intervals of not more than 1 minute, when on the starboard tack, 1 blast, when on the port tack 2 blasts in succession, and when with the wind abaft the beam, 3 blasts in succession.

(e) A vessel when at anchor shall at intervals of not more than 1 minute, ring the bell rapidly for about 5 seconds.

Sailing vessels and boats of less than 20 tons gross tonnage shall not be obliged to give the above-mentioned signals, but if they do not they shall make some other efficient sound-signal at intervals of not more than 1 minute.

I would have you remember that the Canadian law over article 28 gives sound signals for vessels in sight of one another, and the word "short blast" shall mean a blast of about 1 second duration. Article 11 says: "A vessel under 150 feet in length, when at anchor, shall carry forward where it can best be seen, but at a height not exceeding 20 feet above the hull a white light in a lantern so constructed as to show a clear uniform and unbroken light all round the horizon at a distance of at least one mile"; and then the same article says "a vessel of 150 feet or upwards in length (and the length, remember, I said shall be deemed to be the length appearing on her certificate of registry), when at anchor, shall carry in the forward part of the vessel at a height of not less than 20 feet and not exceeding 40 feet above the hull, one such light, and at or near the stern of the vessel, and at such a height that it shall not be less than 15 feet lower than the forward light, another such light (remember the difference between a vessel's lights under 150 feet and over as prescribed by the law). And then again a vessel aground in or near a fairway shall carry the above light or lights, and the two red lights in article 4, which is two red lights in a vertical line one over the other not less than 6 feet apart, and of such a character as to be visible all round the horizon at a distance of at least 2 miles. And then we have the regulation for produce boats, canal boats, fishing boats, rafts and other water craft, navigating any bay, harbor or river by hand power, horse power, by sail or current, or which shall be moored or anchored in or near the channel or fairway of any harbor or river, and not otherwise provided for, shall carry one bright white light forward not less than 6 feet above the deck.

Rafts shall carry in each case on a pole not less than 6 feet high, a bright white light visible all around the horizon as follows: "Rafts of 1 crib in width and not more than 2 in length shall carry 1 such light. Rafts of 3 or more cribs in length, 1 such light on each end of the raft. Rafts of more than 1 crib abreast shall carry 1 such light on each outside corner, making 4 lights in all.

Bag or boom rafts navigating or anchored in the fairway of any bay, harbor or river, shall carry a bright white light at least 6 feet high at each end of the raft and 1 such light on each side midway between the forward and after end. All double-ended ferryboats shall carry a central range of bright white lights showing all around the horizon placed at equal heights forward and aft, and shall also carry the lights specified in Article 2, Clauses (b) and (c).

Article 12.—Every vessel may, if necessary, in order to attract attention, in addition to the lights which she is by

these rules required to carry, show a flare-up light or use any detonating signal that cannot be mistaken for a distress signal.

Article 13.—Nothing in these rules shall interfere with the operation of any special rules made by the Government of any nation with respect to additional station and signal lights for two or more ships of war or for vessels sailing under convoy, or with the exhibition of recognition signals adopted by shipowners, which have been authorized by their respective governments and duly registered and published.

Article 14.—A steam vessel proceeding under sail only but having her funnel up, shall carry in day-time, forward, where it can best be seen, one black ball or shape 2 feet in diameter.

We will now read over the preliminary in so-called Risks of Collision and in learning the Rule of the Road as set down by the Canadian Government, and it is a duty to ourselves that we should memorize the following articles that I am about to read—we do not of course bind you down word for word, but if you have to learn them you cannot put them into better words, and at a Court of Inquiry often a little word like "if" or "and" may be of a serious nature. As I said the other night in regard to taking another vessel bearing of an approaching vessel, if the bearing does not appreciably change, such risk should be deemed to exist.

Article 17.—When two sailing vessels are approaching one another so as to involve risk of collision, one of them shall keep out of the way of the other, as follows, viz.:

(a) A vessel which is running free shall keep out of the way of a vessel which is close-hauled.

(b) A vessel which is close-hauled on the port tack shall keep out of the way of a vessel which is close-hauled on the starboard tack.

(c) When both are running free, with the wind on different sides, the vessel which has the wind on the port side shall keep out of the way of the other.

(d) When both are running free, with the wind on the same side, the vessel which is to the windward shall keep out of the way of the vessel which is to leeward.

(e) A vessel which has the wind aft shall keep out of the way of the other vessel.

Article 18.—When two steam vessels are meeting end on, or nearly end on, so as to involve risk of collision, each shall alter her course to starboard, so that each may pass on the port side of the other.

This article only applies to cases where vessels are meeting end on or nearly end on in such a manner as to involve risk of collision, and does not apply to two vessels which must, if both keep their respective courses, pass clear of each other.

The only cases to which it does apply are when each of the two vessels is end on, or nearly end on to the other; in other words, to cases in which, by day, each vessel sees the masts of the other in a line, or nearly in a line with her own; and by night, to cases in which each vessel is in such a position as to see both the side-lights of the other.

It does not apply, by day, to cases in which a vessel sees another ahead crossing her own course, or by night to cases where the red light of one vessel is opposed to the red light of the other, or where the green light of one vessel is opposed to the green light of the other, or where a red light without a green light, or a green light without a red light is seen ahead, or where both green and red lights are seen anywhere but ahead.

Article 19.—When two steam vessels are crossing so as to involve risk of collision, the vessel which has the other on her own starboard side shall keep out of the way of the other.

Article 20.—When a steam vessel and a sailing vessel are proceeding in such directions as to involve risk of collision, the steam vessel shall keep out of the way of the sailing vessel.

Article 21.—Where by any of these rules one of two vessels is to keep out of the way, the other shall keep her course and speed.

Note.—When, in consequence of thick weather or other causes, such vessel finds herself so close that collision cannot be avoided by the action of the giving-way vessel alone, she also shall take such action as will best aid to avert the collision. (See articles 27 and 29.)

Article 22.—Every vessel which is directed by these rules to keep out of the way of another vessel shall, if the circumstances of the case admit, avoid crossing ahead of the other.

Article 23.—Every steam vessel which is directed by these rules to keep out of the way of another vessel shall, on approaching her, if necessary, slacken her speed or stop or reverse.

Article 24.—Notwithstanding anything contained in these rules, every vessel overtaking any other shall keep out of the way of the overtaken vessel.

Every vessel coming up with another vessel from any direction more than two points abaft her beam, i.e., in such a position, in reference to the vessel which she is overtaking, that at night she would be unable to see either of that vessel's side-lights, shall be deemed to be the overtaking vessel, and no subsequent alteration of the bearing between the two vessels shall make the overtaking vessel a crossing vessel within the meaning of these rules, or relieve her of the duty of keeping clear of the overtaken vessel until she is finally past and clear.

As by day the overtaking vessel cannot always know with certainty whether she is forward of or abaft this direction from the other vessel, she should, if in doubt, assume that she is an overtaking vessel and keep out of the way.

Article 25(a).—In narrow channels every steam vessel shall, when it is safe and practicable, keep to that side of the fairway or mid-channel which lies on the starboard side of such vessel.

(b) In all narrow channels where there is a current, and in the Rivers St. Mary, St. Clair, Detroit, Niagara and St. Lawrence, when two steamers are meeting, the descending steamer shall have the right of way, and shall, before the vessels shall have arrived within the distance of half a mile of each other, give the signal necessary to indicate which side she elects to take.

Article 26.—Sailing vessels under way shall keep out of the way of sailing vessels or boats fishing with nets, or lines, or trawls. This rule shall not give to any vessel or boat engaged in fishing the right of obstructing a fairway used by vessels other than fishing vessels or boats.

Article 27.—In obeying and construing these rules, due regard shall be had to all dangers of navigation and collision, and to any special circumstances which may render a departure from the above rule necessary in order to avoid immediate danger.

This is an everlasting subject that needs our careful study and we should endeavor to remember it once we have learned it, for we never know the moment it would be required of us, and I would have you remember that when we are speaking of a meeting ship or vessel whether it may be two steamers or two sailing vessels or one sailing ship and one steamer, that we should speak of meeting, when we can see the red and green light at one time or the mast or mast and funnel in one that would be a meeting vessel, and then if we can see a vessel from the bow either one side or the other to two points abaft our beam, we should consider that vessel an approaching vessel or crossing vessel, and then again if we should see a vessel anywhere from two points abaft our beam on the port side or starboard side round our stern to two points abaft the other beam, that would be considered an overtaking vessel. Now I hope that we have gotten hold of something that may be of some assistance to some of us.

The Canadian Merchant Service Guild has decided to champion the cause of the British Columbia pilots if no satisfactory arrangement is made between the Government and the pilots within the next few days. This decision was reached on Saturday after a long discussion and consideration of the situation. The guild includes all of the masters and mates sailing coastwise on the British Columbia coast and most of the deep sea masters and officers.

It will take the negotiations from the hands of the pilots and make it a guild matter, purely and simply, according to information obtained from the pilots this morning.

Meantime there is another conference between pilots and Pilotage Superintendent Captain George Robertson. This is being held at Victoria. Capt. Robertson is assisted by Mr. A. Boyle, chief accountant for the department of marine and fisheries.

Annual Meeting of Western Section of C.M.S.G.

THE western section of the Canadian Merchant Service Guild held their annual meeting at Vancouver recently, with Captain Wearmouth, the president for 1919 occupying the chair. The business done consisted in the presentation of a report of the year's activities by Captain Wearmouth, the election of officers for the coming year, the secretary's report, and speeches from various members.

Captain Wearmouth, in his speech, explained that the report of the Royal Commission on the Canadain Merchant Service Guild's dispute with the shipowners had been presented to the guild in January last. Owing to the illness of the secretary and an accumulation of detail work, it was not immediately acted upon. The report, however, proved useless to the guild owing to the fact that it contained no decision on the question of recognition of the organization by the shipowners. However, negotiations were continued with the different firms, which culminated in an increase of $25 per month for masters and mates, together with improvement in working conditions. These negotiations had taken time, and it was only very recently that the Canadian Pacific had signed the agreement. The Union Steamship Company had given them to understand that they would meet the raise that the C. P. R. had granted, and the Grand Trunk Pacific Steamship Company had agreed to meet the Guild representatives to discuss certain conditions sought by the organization. There was some delay in settling the tugboat situation, but Captain Wearmouth hoped to see that also adjusted in the very near future. While being strongly opposed to direct action, preferring negotiation and arbitration, he stated that if it ever became necessary the strike could be resorted to. Referring to deep sea ships, conferences had been arranged with Captain E. Beetham, manager for the Canadian Pacific Ocean Services, Captain Wingate, acting superintendent for the Canadian Government Mercantile Marine. The meeting with Captain Beetham had been very satisfactory to the Guild, and it was confidently hoped that the differences between the Guild and the Government steamship line would be soon adjusted.

The following officers were elected for the year 1920: Captain A. Gilchrist, president; vice-presidents. B. C. Lakes, Capt. J. B. Weeks; Nanaimo, Capt. D. Martin; Prince Rupert, Capt. J. J. Mulligan; Vancouver, Capt. J. E. Noel; Victoria, Capt. T. H. Brown; Yukon, Capt. J. O. Williams: repersentatives of classes of vessels, ocean-going, Capt. R. A. Batchelor; local passenger ships, Capt. B. Donald; local freight boats, Capt. J. McNaughton; towboats, Capt. W. W. Best; licensed pilots, Capt. J. C. Foote.

After the election Captain Gilchrist took the chair until he was forced to leave, having to take his ship to sea. Captain Wearmouth then took the chair for the remainder of the meeting.

Captain Gilchrist thanked the members for the honor they had done him in electing him to the highest office in their organization, and assured them of his constant interest and endeavor for the Guild. During the year previous he had been vice-president for Nanaimo, and had had a busy time. He also gave it as his opinion that negotiations were better than strikes. He mentioned the good reception that representatives of the Guild had enjoyed from members of the shipping firms at conferences, and spoke of the good results obtained. He would endeavor during his term of office to hold the ground already gained, and to continue by peaceful means to seek better conditions still. He pointed out, in support of his objections to a strike, the responsibility resting on the officers of coasting vessels, stating that there were thousands of women and children up the coast who depended on the steamboat service for their very existence. He was expecting that before very long the organizations of the Great Lakes and the Maritime Provinces would be linked up with the western section of the Canadian Merchant Service Guild, and this would mean a great increase in strength and influence. The day had arrived when the ship's officer must be given proper respect and consideration, and occupy his rightful place in society. He assured the junior officers that their interests would not suffer because of the election of so many captains to office, but that they would be considered first in all matters. The introduction of the three-watch system, he said, depended quite a lot on the members of the Guild. He did not think that shipowners would object much if a satisfactory scheme could be evolved. Captains Gun and Ford, trustees, reported the accounts and financial affairs satisfactory. They recommended an increase in the salary of the secretary and stenographer. The appointment of an assistant to the secretary was also recommended.

Captain Parker, of the executive, spoke briefly. He thanked the members for the support accorded the executive during the past year and spoke in an appreciative strain of the spirit of co-operation manifested by the board members. He felt sure that a satisfactory agreement with the towboat owners would soon be arrived at.

Captain Snoddy spoke at some length, taking occasion to point out the fallacy of radical ideas. He pointed out that capital and labor were indispensable to each other, and to kill one would be to murder the other. To the conservative members he pointed out that changes came in the natural order of things sooner or later. He expressed great pride in the Guild and what it had accomplished, and urged the members to take an active interest in all the affairs of the Guild, thus assisting the development and lightening the duties of the officers.

The secretary, Mr. A. Goodlad, presented his annual report. During the year 160 new members joined, five members died, two are operating under foreign flags, one became an owner, and one was appointed to shore work. The total membership, including nine honorary members, was now 606. Among the new members were a number who had won distinction during the war, these including a D.S.C., a D.S.O., and an O.B.E. Seventy-six of the new members were veterans of the war.

The financial statement showed $2,579.36 on the books, with $1,781.06 in the bank, not including the special reserve fund of $2,427.61. The difference between the book balance and the bank balance was made up of unpaid dues and expenditures on furniture. Discussing the work of the year, he said:

"Now, with regard to our progress in the way of securing conditions for our members, we have not got near what we anticipated, but we have gained considerable. In some cases we have been able to secure an increase of $25 a month for every man and have been successful in getting an agreement with one company —I might say the C. P. R.—whereby we are getting put into operation the annual holiday of two weeks and a system of one day off in seven, and on some of the boats an eight-hour day.

"With the Union Company, although we have not signed an agreement, the management has granted and paid an increase of $25 per month flat to the certificated deck officers, and made enormous improvements for the men in the service, and in this company there is very little more to adjust at this time. In the G. T. P., while they have granted the increase of $25 per month and two weeks holidays annually there remains the matter of one day off in seven and suitable accommodations for officers. The company has agreed to arrange a joint committee to discuss this matter."

The members who died during the year were Captain Magnus Furustad, Captain A. C. Anderson, Captain W. J. Owen, Captain William Turnbull and Captain J. R. McMicking. Captain Turnbull was vice-president for the Yukon district.

London.—It is said here that it will not be very long before Germany will be in a position to build 1,000,000 tons shipping per annum. By the terms of peace she is compelled to lay down 200,000 tons per annum for the Allies. What will be done with the surplus of 800,000 tons is the subject of a good deal of interest to those in the shipping business.

B.C. Shipbuilders Repair Strange Craft

The Aeroplane " In Dock" for the First Time in the Annals of British Columbia Shipping History. Messrs. Yarrow Reconstructed Aerial League Curtiss Biplane "Pathfinder," After Serious "Crash"

By OMADHAUN

ANYONE watching a travelling crane at work in a modern shipyard, handling masses of steel that weigh unbelievable tonnage, comes to the inevitable conclusion that here at least is a class of work that calls for rugged strength, both of machinery and personnel.

To see a ten-thousand-ton ship hauled out on the ways, and watch, as the gaping hole in her side is stripped and replated, is to witness an epic in the mechanical ingenuity of the modern brain of mankind.

Then to see the same plant, accustomed to the handling of large-tonnage ships, take charge of a twisted mass of gossamerlike wreckage of a modern flying machine, separate it into its delicate components, repair the crushed members and reassemble the machine into a military two-seated aeroplane, is to have witnessed a miracle of adaptability that is almost beyond the imagination to conceive.

Such is the record, though, that is now laid to the doors of a well-known shipbuilder in British Columbia, Messrs. Yarrow, Limited. When the Aerial League of Canada had the misfortune to "crash" its first Curtiss aeroplane in Vancouver early in the summer of 1919, Mr. Norman Yarrow offered to have the machine repaired at his plant at Esquimalt, near Victoria, B. C. The offer was gratefully accepted and accordingly the twisted mass of wreckage was conveyed to the ship-building plant at Esquimalt.

In Flying Corps circles the "Pathfinder," as the Curtiss was called, would have been known as a complete "write-off," which in ordinary English means that it would not have been worth repairing under the stress of war conditions. The fuselage, or main body, of the aeroplane was badly wrenched (twisted with what a nautical man might have called a list to port). The wing sections were hopelessly smashed up, the main spars and ribs being in very small fragments. Indeed, about the only member of the unfortunate flying machine that could have been recognized as such was the rudder, a specially shaped section which, being steel-ribbed, and not having been underneath in the "crash," retained a semblance of its former appearance. Occupants of the machine, as curiously enough often is the case, were practically undamaged by the fall, one having sustained a slight fracture of the nose,, and the pilot having been very slightly bruised.

Behold, then, the riggers, fitters and painters of Messrs. Yarrow's plant confronted with a jumbled mass of delicate woodwork, mostly in six-inch pieces, and an odd assortment of turnbuckles and metal fittings the like of which had never before been seen by them. Blue prints of the Curtiss aeroplane were given to the distressed mechanics, and only served to make the problem more involved if possible.

However, there is a solution to even the most abstruse problem, and it was not long before the employees of Yarrow's ship-building plant could talk convincingly on the construction of modern aircraft. The Aerial League supplied a few technical details from time to time, and generally kept in touch with the work as it progressed, the riggers being very materially assisted by Mr. Robertson, a former aircraft inspector for the Imperial Air Ministry, who inspected each piece of material as it was placed in the machine, stamping it with his official "O. K."

How the machine daily began to take on shape, and part by part was assembled, would take a book to describe. Suffice it to say that the fuselage was erected, with good Canadian spruce and British Columbia material predominating in the ratio of 98 per cent. The wing sections, four in all, were reconstructed throughout with lumber obtained in the local Victoria mills. A feature of the wing construction was the placing of single-piece main spars (the lateral members of the wings running from tip to stem) instead of the spliced spars that the makers had to use owing to the shortage of suitable lengths of spruce in the Eastern factories of the Curtiss Aircraft Corporation.

When the woodwork had been entirely reconstructed, the problem of covering the wings and fuselage with linen fabric occurred, and it was discovered at this point that linen was the only material that British Columbia could not supply in the finished state. Aeroplane fabric was imported from the East by the Aerial League, and Yarrow employed upholsterers of Weiler Bros., Victoria, to stitch the fabric onto the sail surfaces, in the regulation manner called for by Mr. Robertson, the aircraft inspector.

Finally the machine stood ready, in its component and assembled parts, to receive the first of three coats of weatherproofing varnish that was to tighten the fabric around its frame and render it smooth to the rush of air it would have to withstand in flight. This coating is called "doping" in flying circles, and it is an extremely delicate operation, calling for care and exactness of application that would surprise the uninitiated. The dope consists of a mixture of chemicals the formula of which is held a secret by the makers, but it is known to the world as "Cellon Dope."

To meet the exacting requirements called for in treating the fabric with dope, Messrs. Yarrow utilized their painting shed, with extensive alterations and additions to make it fill the requirements of the situation. Heaters were installed to bring the rooms up to a steady level of some 80 degrees Fahrenheit, and maintain it there, a thermometer being used as a check on the temperature. The doping shed was rendered practically airtight, to assist the temperature requirements, and so a fan had to be installed to supply the workers with air and take away some of the fumes of the cellon dope.

Anyone who has had the pleasure of working on "dope" for aircraft will remember the unearthly effluvia that the villainous cellon dope emanates. In the Royal Air Force mechanics doping machines are allowed to smoke, and that is the one time where they are allowed to smoke when within ten yards of any aircraft.

Also they are given milk to drink in large quantities, which is said by the medical authorities to counteract, even if only slightly, the obnoxious fumes given off by the powerful solution.

However, without smoking, and completely horrified at the idea of absorbing milk, the willing workers of the shipbuilding plant buckled to and doped that machine (no — not from head to foot) from wing-tip to tail with three hearty coats of the nasty-smelling fluid. As a result of their labors the "Pathfinder" to-day presents a finished fabric surface that is second to none on any aeroplane in the entire Empire, and Mr. Robertson went on record as supporting that statement.

A curious point that transpired in this connection was the fact that the usual Valspar varnish being unobtainable in British Columbia, a stock varnish from Messrs. Pendrays (British - American Paint Company) proved not only equal in merit, but was said by some to surpass the famous aeroplane varnish that had been used by the Air Force during the war. Be that as it may, the finish of the aeroplane fabric on the "Pathfinder" to-day is a lasting testimony to the fact that local products can turn out the highest grade of workmanship and material in the aircraft industry.

The "Pathfinder," rejuvenated and trim, will take the air long before this article is in print, and as she leaves the ground, the first modern two-seated aeroplane built by ship-builders anywhere in the New World, will be seen in flight over the homely scenery of the Gulf of San Juan. Mr. Norman Yarrow, the representative of the famous Clyde shipbuilders in Scotland, has been responsible for bringing home to the people all over the West the fact that aircraft can be made right here in our back yards (so to speak), and if need be Canadians can

turn out machines that will not be surpassed the world over.

A keen enthusiast in all matters aeronautical, Mr. Norman Yarrow is the donor of the Prince of Wales Airship Prize of $50,000, which will be given to the first Canadian-built airship to cross the Pacific Ocean from Vancouver Island to Japan. The conditions of the prize are as follows:

1. The airship (lighter than air) shall be manufactured in Canada, including all parts and materials. Any parts and materials that are not being made in Canada at the time the airship is constructed may be imported.

2. The airship shall be navigated and manned by Canadians only during the trans-Pacific flight.

3. The flight shall be non-stop, from Vancouver Island, B. C., to Japan.

4. The flight shall be performed prior to December 31, 1921.

5. The award shall be made by the Premier of British Columbia, whose decision shall be final.

6. Any person or corporation desiring to compete for the prize shall advise Mr. Norman Yarrow, or the Aerial League of Canada (Victoria branch), and upon a *bona fide* entry being made, the above amount will be deposited in the Victoria branch of the Bank of Montreal within three months from that date.

Mr. Yarrow's object in offering the prize is to commemorate the visit of the Prince of Wales, to encourage in Canada the development of a new industry which has a great future before it, and to promote good feeling between the countries touched. Being left so hopelessly out of the stirring adventures of crossing the Atlantic by air, and yet having given the flower of her manhood to the Imperial Flying Services, it is to be hoped that Canada will pull down the Yarrow Airship prize before an outsider corrals the honor.

WEATHER OBSERVATIONS AT SEA

In a recent pamphlet issued by the United States Weather Bureau, entitled, "The Marine Meteorological Service of the United States," attention is invited to the need for weather and water temperature observations from as many ships as possible. The commercial value of the work is explained, as well as the several uses to which the observations are put, and a brief history of this young but valuable science is given, which concludes with the opinion of Lieut. Matthew Fontaine Maury, United States Navy, one of the great pioneers of ocean meterorology, that "we must look to the sea for the rule" in meteorology.

The Hydrographic Office wishes to associate itself actively with the Weather Bureau in this plea for more voluntary observers. The young men who in recent years have been drawn to the sea for service in the Navy and the Shipping Board's fleet have found ready for their use the periodical pilot charts of the several oceans, the storm-warning signals, and the special daily forecasts by radio. They must not suppose that all these rest upon guesswork or theory, for they are based in large part upon the steady stream of weather observations that flows daily into the Weather Bureau. The fuller that stream is and the more accurate its composing elements are, the better and more helpful to the seafarer will be the results. Self-interest alone, if other motives are not yet aroused, should prompt every seagoing officer to get in closer touch with this branch of his profession and give it at least the brief daily attention required of a co-operating observer. Just what that is can be learned by inquiring of the Weather Bureau or its nearest seaport station, where the above-named pamphlet can also be had.

BRITISH FOREIGN TRADE

For November the balance of trade against Great Britain was the lowest since the armistice. Exports were double those for the early months of the year, and $45,000,000 more than in October. Imports were decreased by practically $50,000,000 from October figures. The increase in exports to £107,000,000 and the decrease in imports to £143,600,000, reflect, in the opinion of the American Chamber of Commerce in London, the effect of the recent strikes in the United States. Curtailed production and shipping troubles not only kept down American imports but improved England's trade with countries shut off from their usual sources of supply in the United States.

As regards imports, advances in value were recorded in the food, drink and tobacco classification, in raw materials, manufactured articles declined by almost £2,000,000. Raw cotton was responsible for a very large advance both in value and in quantity. Wool, wood, and timber rose. Miscellaneous manufactured articles and metal manufactures other than iron and steel, fell. Chemicals also fell. Iron and steel, textile and leather manufactures rose, also paper.

The total exports consisted of about £87,100,000 of British goods and £20,300,000 imported goods re-exported. The great increase in exports of the produce and manufactures of the United Kingdom was in manufactured articles, which advanced in value by almost £34,000,000, an indication that British production is slowly rising. This increase is largely accounted for by textile manufactures, including cottons, woollens, worsteds, silks, etc. Cotton yarns also increased. Iron and steel and machinery increased. Food, drink, and tobacco rose, as also did raw materials. Coal exports were again about 3,000,000 tons, as in October, but the average value per ton increased, making the total receipts £9,600,000.

BOTTLE PAPER DRIFTS

A bottle paper set adrift by the American steamer "Coalinga" on July 21, 1917, in lat. 19° 46′ N., lon. 85° 51′, was recovered at Farmer's Key, North Exuma Island, in April, 1919.

A bottle paper set adrift by the French schooner "Felix" on March 13, 1918, in lat. 21° 38′ N., lon. 57° W., was recovered on the beach at Spanish Point, Pembroke Parish, Bermuda, on May 4, 1919.

A bottle paper set adrift by the American bark "Benicia" on Jan. 12, 1919, in lat. 19° 15′ S., lon. 153° 20′ W., was recovered off the Island of Mangaia, Cook Islands, on Feb. 26, 1919.

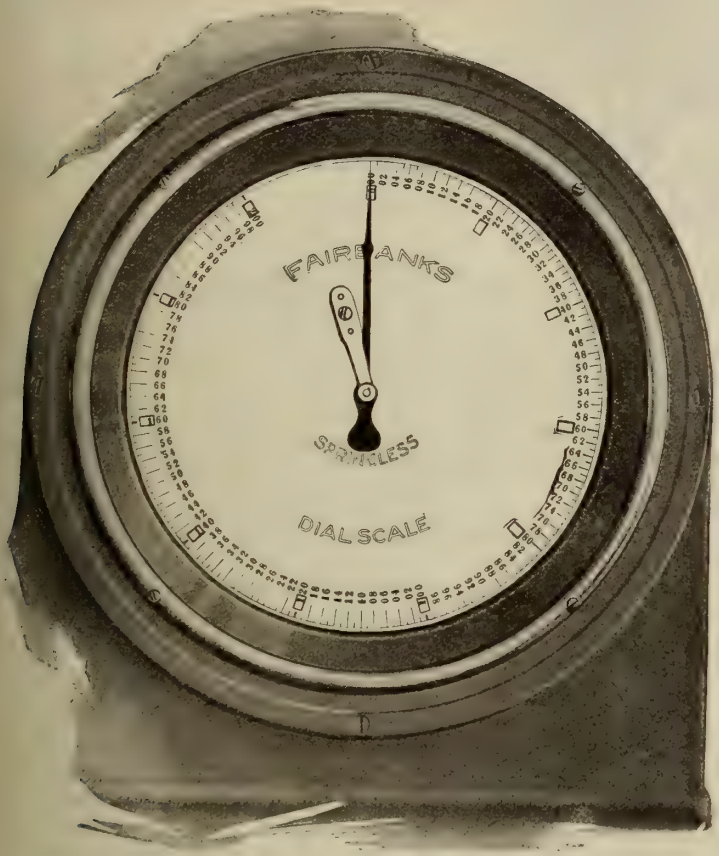
A bottle paper set adrift by the American steamer "Santa Flavia" on Mar. 23, 1919, in lat. 24° 48′, lon. 87° 28′ W., was recovered about 30 miles south of St. Augustine, Fla., on May 18, 1919.

A bottle paper set adrift by the American steamer "Stephen R. Jones" on May 20, 1919, in lat. 7° 50′ S., lon. 33° W., was recovered off Natal, Brazil, on June 12, 1919.

STRENUOUS WORK FOR TOWING MACHINES

CONTINUED demand for Canadian-made marine equipment is indicated in reports from manufacturers of towing machines, cargo winches, deck hoists, steering apparatus, etc., and very much of this machinery is being employed in strenuous spheres of usefulness. The Corbet Foundry & Machine Co., Owen Sound, state that the Government wrecking tug, the "Lord Strathcona," which is equipped with one of their No. 5 towing machines, has been engaged recently on heavy service in connection with the several groundings and wrecks on the Atlantic coast. For the time being the tug's headquarters have been shifted to Halifax. The G. T. P. tug "Lorne," equipped with Corbet machines, is the largest on the Pacific coast, while the "Strathcona" is the largest on the Atlantic coast. The tug "Lucknow," of the Midland Transportation Co., also having Corbet equipment, is the largest tug on the Great Lakes.

As indicating the service that her Canadian-made equipment is performing, the Corbet people recently received a letter from a large Buffalo shipbuilding concern, stating that five of the six automatic steam-towing machines have been placed in U. S. navy tugs. These machines all passed the preliminary trials. The first tug has been in commission all summer, towing barges from Chicago to Buffalo, and has met all requirements. The other tugs have escorted Eagle boats from Buffalo to New York over the St. Lawrence route. The automatic release and take-up possible by use of the Corbet machines means a practical economy in the application of power to towage, there being no pulling and hauling and jerking, as is the case when the automatic take-up is lacking. Some thirty of these machines are in use on the Pacific coast. Many others were sent to the Atlantic, and not a few have been supplied to foreign buyers.



Cut Time and Labor Costs

—stop and figure out the time wasted in weighing and computing weights. It amounts to considerable in a year.

Fairbanks
Dial Scales

eliminate all the waste time and labor it is possible to save. They put your weighing on an efficient basis. The plainly graduated dial does this.

Ask us about these scales, and the work they will do in your plant.

The Canadian Fairbanks-Morse Co., Limited

ST. JOHN, QUEBEC, MONTREAL,
CALGARY, WINNIPEG, SASKATOON,
OTTAWA, VANCOUVER, VICTORIA.

Marine News From Every Source

Vancouver.—The Coughlan Shipbuilding Company successfully launched the steamer "Canadian Exporter," 8,100 tons deadweight, for the Canadian Government Merchant Marine recently

Quebec.—The Three Rivers Shipyard Company has received a contract for the construction of six steel vessels, of 7,200 tons. Work is being pushed ahead, and in the early spring it is expected that 3,000 men will be employed.

New York. — The Newark Bay Shipyard has been acquired by the Submarine Boat Corporation from the United States Emergency Fleet Corporation. The Newark Bay Company have been operating the yard under a lease. The yard cost to construct $15,000,000.

Cleveland.—Chartering for the opening of navigation has been commenced, half a dozen steel steamers having been placed for grain at 4 cents from head of Lake Superior to Buffalo, and 4¼ cents storage in Chicago and spring delivery in Buffalo.

British Columbia's Ship Output.—During the year of 1919 the shipbuilders of the Pacific Coast built 170,500 tons. This included ten steel and forty-six wooden vessels. The French Government took forty wooden vessels, the Imperial Munition Board took four steel steamers, and six have been built for the Canadian Merchant Marine.

Montreal. — The Canadian Pacific Ocean Services are to add three steamers to their fleet, and these are being at present constructed in Scotland. They will be called the Montcalm, Matapedia, and Montmorency. They will be of 16,000 tons each, fitted for burning oil fuel, and will be in commission during the latter part of 1920.

Victoria, B.C.—The construction of the first demountable ship will be commenced in Seattle very shortly, according to Mr. John Arbuthnot, the originator of the plan. The demountable ship is really a cargo of lumber put together in the form of a ship, and supplied with oil engines and sails, with which the cargo transports itself across the ocean.

Big Contract for Vancouver.—The firm of J. J. Coughlan & Sons have secured from the Dominion Government a subsidy contract for the building of the large drydock at Vancouver, the estimated value of the dock being $3,750,000. The firm will finance the construction, and get a percentage subsidy when the work is completed.

Collingwood.—The Canadian Farmer was launched successfully from the yards of the Collingwood Shipbuilding Company during the Christmas season. The steamer is the fourth one built in this yard for the Canadian Merchant Marine. She will be fitted out during the spring and go down the canals at the opening of navigation.

Halifax. — The captain of the tern schooner G. H. Murray telegraphs from Cuba that the schooner has been wrecked on the Coloradoes Reef and is a total loss. The schooner was built at Comeauville, N. S., last year, and was bound from Havana to San Domingo with a cargo of sugar. The crew are believed to be safe.

Charlottetown, P.E.I.—The loss of the schooner Barbara McDonald was felt very heavily in Prince Edward Island. She was on her maiden voyage and only a few days before she was wrecked her captain was lost overboard. She was the second schooner built on the island recently, the launch of her predecessor, the Victory Chimes, being looked on as the revival of shipbuilding, which once flourished on the island.

Cleveland.—Ice in the Great Lakes caused some damage to belated vessels and caused some of them to be diverted from their destination. The steamer "Stadacona," bound for Buffalo, with grain, was diverted to Port Huron. The B. F. Berry, ordered into winter quarters at St. Ignace, went into the slip without lightering. Some vessels sustained damage to hulls, and one or two lost propeller blades.

Halifax. — Dartmouth, just across the harbor from Halifax, has been chosen as the site for a branch of the Winnisimmet Shipyards, of Chelsea, Mass. The announcement was made by C. N. Delaite and Maxwell Jackson, who have spent the past few days in Nova Scotia looking for a suitable location. W. R. Green, the president of the company, will come to Halifax shortly, to conclude the deal.

Quebec. — The Davie Shipbuilding Company, at Lauzon, has resumed operations with about 1,000 men. Before closing down, the works employed about 1,500 and will again employ that number when in full operation. There has been no change of management in the plant, the rumor that the Canada Steamships Co. had taken it over not being substantiated. It was stated by officials of the Davies Company that the Canada Steamship Lines had merely endorsed some financial papers.

Montreal.—The British War Department has turned the former German liner Prince Frederich Wilhelm over to the C.P.O.S., and she will sail from New York shortly to England, to be refitted. She will be placed on the Canadian service when repairs are completed. She was formerly owned by the North German Lloyd, and is of 17,082 tons gross, 590 feet long by 68 feet by 38 feet. She will make the passage from Liverpool to St. John in less than seven days.

St. John, N.B.—The Mayor and Council of St. John have been receiving letters of complaint from owners and agents of steamships which have been compelled to wait in the harbor until a berth could be found for them. One vessel claimed that some perishable freight had been spoiled by cold, due to the vessel having been awaiting a berth for seven days. The harbor commissioner stated there was little chance of the congestion being relieved in the immediate future.

Toronto.—The Dominion Shipbuilding Company successfully launched the full canal-sized freighter, "Torontonian," from their yards recently. The vessel is as sister ship of the "T. L. Church," launched a few weeks ago. The launch was made interesting from the fact that the ice in the bay had to be broken and kept broken by tugs preparatory to the launch. The vessel was christened by Mrs. C. H. Easson, wife of Mr. C. H. Easson, general manager of the Standard Bank of Canada. This makes the ninth vessel to be launched from this yard in the past twelve months. Six of these vessels have been delivered.

America Gets Ship Contracts.—Although the price per ton is much higher than that of British yards, several contracts have gone to American builders recently through inability of British firms to take any more work just now. The Pusey & Jones yard on the Delaware have taken an order for 12,000 ton deadweight tank steamers, and the Bethlehem Shipbuilding Corporation have received orders for four 10,000 ton vessels of the same type. The price is said to be in the neighborhood of $205 per ton. While British prices are considerably below this, they cannot compete on a delivery basis.

Indifference to the Stop Cock!

You know what that means.

Ruin to the whole Steam System.

The loss of money and time to the client.

And the loss of the client's confidence in the sanitary engineer who installed the system.

It is worse than folly to pass on inferior stop cocks when Empire Steam Stop Cocks are available—and Empire Steam Stop Cocks always are available.

The factory test of the Empire Manufacturing Co. and our guarantee is behind the engineer who installs our stop cocks. Remember our guarantee has never failed.

A square client deserves Empire Steam Stop Cocks—they are the quality of stop cocks he expects from a reliable sanitary engineer.

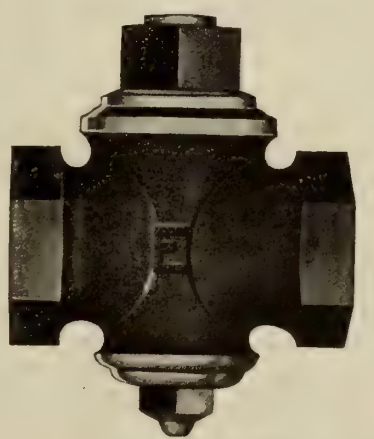


Plate A-810.

EMPIRE MANUFACTURING CO., Limited

London and Toronto

Canada

CANADA'S FOREIGN SHIPBUILDING

The extent to which Canadian shipyards contributed to the tonnage of other countries in the year just closed, was not exactly known at the time that this publication went to press, but by the courtesy of the Deputy Minister's office of the Department of Marine and Fisheries, some figures were furnished showing the operations in this respect for the first eleven months of the year.

There were altogether 65 vessels, representing a total net tonnage of 79,992, which were not registered in Canada and were exported to other countries. Only seven of these, however, were steel ships, and about half of the total number were wooden ships built on the Pacific Coast to the order of French interests. The seven steel ships were divided up among Ontario, Quebec and Nova Scotia.

Following are the official returns covering the year up to the end of November:

NUMBER AND TONNAGE OF NON-REGISTERED VESSELS EXPORTED TO OTHER COUNTRIES—1919.

	Wood				Steel and Steam	
	Sail.		Steam	Net		Net
	No.	Tonnage.	No.	Tonnage	No.	Tonnage.
British Columbia	..	....	32	39,233	..	....
Ontario	..	....	..	.....	2	7,100
Quebec	..	....	8	3,095	2	2,668
New Brunswick	..	....	6	9,238	..	....
Nova Scotia	5	1,567	7	12,436	3	4,656
	5	1,567	53	64,002	7	14,423
Total number of vessels						65
Total tonnage						79,992

CANCELLING CALLS FOR ASSISTANCE AT SEA BY VESSELS IN DISTRESS

The commandant of the U. S. Coast Guard Service, under date of January 3, 1920, states: "It has developed recently that vessels in distress have made urgent calls for assistance and have failed to annul such calls when the need for assistance ceased to exist. This has resulted in some needless cruising by Coast Guard cutters sent to assist, and an expenditure of considerable fuel, which might have been conserved if the calls had been cancelled."

USE OF OIL TO CALM SEAS

On December 26, 1919, while towing the British steamer "Kamarima" towards St. John's, N.F., used oil from the crew's lavatories with good effect, the tow making better weather of it than before using oil. Wind at the time, east, force 8. ["Mesaba" (Br. ss.), Capt. J. G. Hutchinson. Report by Second Officer Harrison.]

CONDENSERS, PUMPS, COOLING TOWERS, ETC.

Revised and enlarged Bulletin No. 112-B, entitled "Condensers, Pumps, Cooling Towers, Etc.," has just been published by the Wheeler Condenser & Engineering Co., Carteret, N.J. This bulletin illustrates the latest developments in condenser practice. It shows a surface condenser containing 50,000 square feet of surface. Sixteen condensers, of approximately this size, are now under construction. These will contain, approximately, 1,000 miles of Crescent Brand tubing drawn in the large Wheeler tube mill. The bulletin shows photographs of a number of actual installations of surface condensers. It illustrates and describes surface condensers, jet condensers, barometric condensers, the Wheeler-Edwards air pump, the Wheeler rotative dry vacuum pump, the Wheeler turbo-air pump, the patented Wheeler steam jet air pump, Wheeler centrifugal pumps for all services, jet condensers, barometric condensers, etc.

BOOK REVIEW

The Coal Consumption of Power Plants and Bonuses for Coal Saving, by Robert H. Parsons. Price 1/- net. The Electrical Review, Ltd., 4 Ludgate Hill, London, E.C. 4.

This monograph of 23 pages, as its name indicates, is devoted to a most important phase of power plant management. It has been written with a view to presenting in handy form the method of establishing and utilizing standards of power plant efficiency devised by the author and used with success. In many large power stations a continuous check upon the efficiency of their operation is now maintained by the method advocated.

CANADA ON THE SEA

In Canada, as in the United States, the great war drove home to thoughtful patriotic men the folly of depending upon strange ships and owners of overseas for the carrying of ocean commerce. Though the whole Dominion was willing and eager to hold up the hands of Great Britain in the world war, it is now frankly and aggressively developing a merchant fleet of Canadian ownership and construction. Sixty steamers are being built and twenty-three are already in commission in the service of the Canadian Government. These vessels are managed as the ships of our Shipping Board fleet are managed, by practical shipping companies. They are under obligation to serve particularly the needs of Canadian commerce. A plan is under consideration for the building of a class of superior transatlantic passenger steamers of 15,000 gross tonnage and a speed of 18 knots, and it is declared that "the Government has no intention of ordering one of these ships outside of Canada, but intends to have them built in Canadian ports, by Canadian workmen, out of Canadian materials."

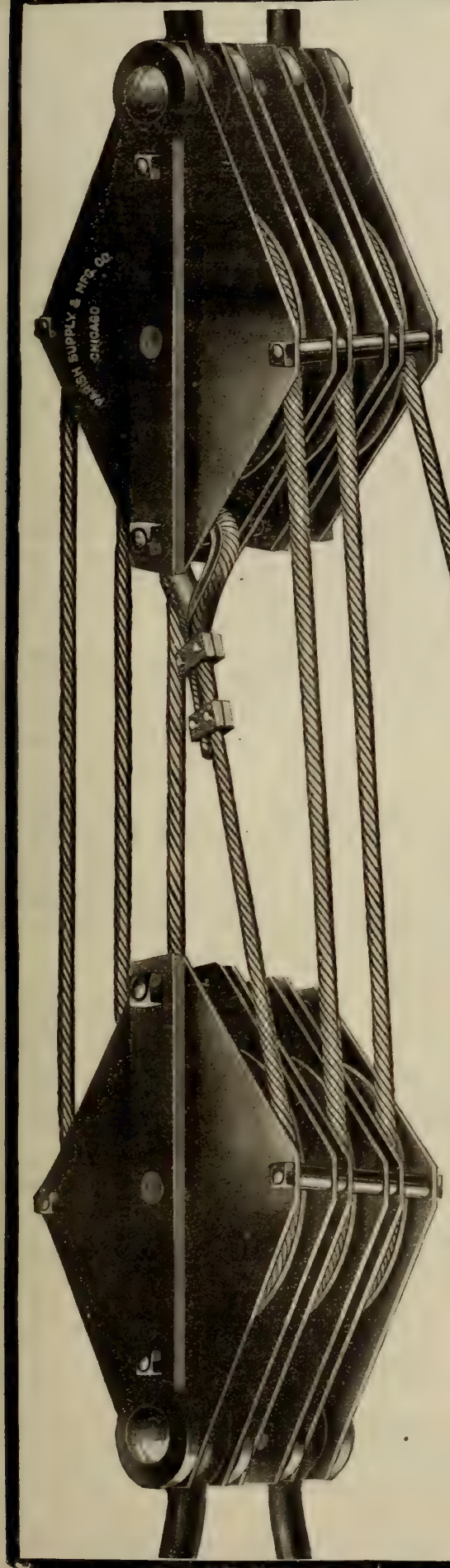
This is an honorable ambition on the part of our neighbors of the north. There is no reason why Canada should not be a substantial factor in the ocean carrying of the world. Time was when good ships and barques hailing from such ports as Yarmouth, St. John, Pictou, Hantsport and Parrsboro, well built and ably handled, were doing their part in deep water carrying. Canada has skillful shipwrights and an excellent seafaring population in the Maritime Provinces. It is by good right that she cherishes the hope of a strong merchant tonnage of her own.—"Marine Journal."

THE LATE CAPT. WILLIAM DULMAGE

The death is announced from Picton of Capt. William Dulmage, after an illness extending over three years. He suffered a paralytic stroke when on board the steamer W. J. Waffle at Kingston in September, 1916, from which he recovered sufficiently to enable him to sit up, and walk occasionally with some help. This condition continued to within two weeks of his death, when he received a second stroke, from which he never recovered. Capt. Dulmage was born in South Marysburgh about seventy years ago, and with the exception of ten years' residence in Picton, resided all his life in his native township. He early began sailing on the Great Lakes, and eventually attained command, which he retained for about twelve years, in the employ first of A. W. Hepburn and later of Hepburn Bros. He is survived by a widow and three sons.

London.—Work on the reconditioning of the three huge liners, "Imperator," "Olympic" and "Aquitania," is proceeding as rapidly as possible. An army of workmen are engaged on the task, and it is hoped that very few weeks will elapse before these three vessels are again in commission. It is asserted that the vessels will be restored to their pristine glory, as far as the internal fittings go, notwithstanding the enormous cost of materials and labor at the present time.

The Pacific Mail Steamship Company, it is announced, is now preparing to extend the trans-Pacific service, both passenger and freight, on a large scale, with at least two monster passenger liners. Manila has been chosen as the new headquarters of the company in the Orient. Two fast liners are being built at Philadelphia for operation between the Philippines and San Francisco.



PARISH SUPPLY & MFG.CO. CHICAGO

Specify Parish Blocks

for strength

Each block is designed and built for a definite working load, and for a rope of a specific size. The working load of the block is equal to the working load of the rope. The tensile strength or breaking strain of the block is sufficient to provide an ample margin of safety.

for service

Sheaves carefully trued and machined to .002 of an inch increase the life of the rope. The perfectly fitted bearings prevent excessive side play and greatly reduce the rope strain caused by swaying loads. The rope fits accurately into the sheave grooves; the strands are not forced apart or confined too closely and there are no rough surfaces to cause excessive friction.

for satisfaction

Built of the best material in every detail, the unusually accurate machine work has reduced bearing wear to minimum. Parish Blocks consequently give more satisfactory service for a longer period without attention and without replacement.

Charts and Catalogue Upon Request.

Parish Supply & Mfg. Co.
2862 Quinn Street
CHICAGO

There is No Universal Panacea for Unrest

Personal Observations of W. R. Basset, President of Miller, Franklin, Basset & Company, of 347 Madison Avenue, New York City

QUACKS want us to believe that there is a magic formula which can be invoked to cure all of the labor diseases in whatever plant or part of the country they may be found. Some have secret processes guaranteed to bathe the face of the erstwhile discontented workman with peaceful, beatific smiles of content.

One demonstrates how pretty five-room cottages with a trellis and a garden hose undoubtedly made self-satisfied, hard-working pillars of society out of I. W. W.'s in a certain town. Another proves that in an Ohio factory the men settled down to a life work of making the boss happy as soon as they were given a voice in the management of the business. And so it goes through the whole list of the cures, whether they be profit-sharing, old age pensions, collective insurance, lunch rooms or baths.

The deuce of it is that every one of these cures have been effective in many plants in bettering the temper of the men. But in many other plants, the same methods have failed miserably.

The trouble is age-old. It is another manifestation of the belief in panaceas, the philosopher's stone, and the fountain of youth. They can't be found.

A pleasant home makes life worth living for self-respecting men, and so conduces to his being better content with his job. But there are a lot of manufacturing concerns which cannot finance such a development. Then there are a lot of foreign-born workmen who will in a week turn a model home into a pigpen. I know, for I've seen it.

Giving the men more or less of a voice in the management of a business has worked fine in plants where the men really wanted to be happy at their work; where they still retained a wish to be craftsmen. But in a plant where radical teachings have sunk into the men; where the direct-actionist idea of seizing all capital has a hold—the plan is too mild to suit the men. Strongly unionized plants under the dictation of powerful labor leaders are not as a rule to be successfully organized under Industrial Democracy.

Piece rate wage-payment plans are usually successful with a thrifty set of men. But in one plant I recently studied a wage incentive failed to spur workers to an easily obtained maximum earning. This plant was in a small town where the living costs were low. Had it been in a large city where it cost more to live, the workers would undoubtedly have needed more money and might have increased production to get it. As it was, we had to invoke the fear of the fellow-workman's disapproval by means of the group economy bonus.

And so it goes. We have a thousand or so industrial districts in the United States, each with its own living conditions. The workers differ in their ideas, outlook on life, education and nationalities. In some districts the men are largely thrifty; in some not. Some are largely home-owners—capitalists in a small way; some are irresponsible floaters. In some towns there is a preponderance of American born workers with their respect for American ideals of government; elsewhere they are mostly foreigners, here only to get the money and go back.

Here we find most of the men have at least a common school education and read good papers; there they do not speak nor read English but get their information from imported radicals and "reds."

With such wide variations in the type of labor from town to town and between different industries, it should be apparent that the employer's problem is almost an individual one. That makes it out of the question to buy a ready-made "system" which can be put into operation in any plant.

I know of factory owners, in every branch of manufacturing, who have no labor problems. They have without exception studied their workers and devised some method of handling them which fit the peculiar conditions. None of them attempted to buy a patent medicine cure.

Although I'm a disbeliever in "sure cures" there is one thing which I believe would lay a foundation for quieter labor conditions in all industries. That is education in the fundamentals of business economics. It is ignorance of this that makes so many formerly contented men prey to the inflammatory false reasoning of agitators.

The source of wages, for instance, is a mystery to most workmen. They are accustomed to cartoons of a fat capitalist with bulging money bags—from which, presumably, he doles out as little as possible in the way of wages. We know that wages are not paid out of capital but from production—but most workmen don't. If they did, it would be easy to convince them that they can reduce the high cost of living by turning out more work in a day.

Few workmen realize that relatively little capital is in the form of money. They don't stop to think that anyone who saves and buys a house or a piano is a capitalist, and that if capital were confiscated, he would suffer with the other, richer capitalists.

He demands interest from the bank on the savings he puts by for old age—but he forgets that the capitalist who builds the plant he works in is also entitled to interest.

We don't teach these fundamentals of economics in our public schools, and you may be surprised therefore to find that even some of your well-up executives are not well enough informed on these basic principles to offer a better argument to Bolshevik teachings than "Oh bunk!"

The radicals know of this ignorance and work upon it. We should combat their false teachings with true ones.

I have perhaps digressed from my main subject—but I did want to show that there is a need for basic education throughout the whole labor structure.

With this fundamentally sound foundation each employer can then go about getting the co-operation of his men in his own way with a much better chance for success.

He can do this in any way he pleases; but if he is wise, he will be careful about experimenting. If he has time, let him search out another concern in his own line, with surrounding conditions and labor supply the same. If this concern has a plan that has worked well, let him adopt it.

Or he may take advantage of the advice of experts, industrial engineers who have installed methods of every sort in all kinds of plants. The wise employer, however, will not, in blind hope, grab any system which has made good elsewhere, perhaps under entirely different conditions.

Just as employers have different interests and ambitions, so workers differ. Some method can be found which will stimulate them to greater production and to a degree keep them contented with their jobs. But exactly the right method must be chosen.

The production of nitric acid in the United States in 1914, according to the Census of Manufactures, was 78,589 tons of nitric acid of average strength and 112,124 tons of mixed acid. According to other data given in the census, these figures represent about 89,000 tons of 100 per cent. nitric acid. All of this acid was produced from nitrate of soda, consuming about 160,000 tons of nitrate. The pre-war importations of nitrate of soda amounted to about 560,000 tons per annum; hence the normal consumption for purposes other than the manufacture of nitric acid was about 400,000 tons. The present rate of importation is about 1,600,000 tons of nitrate per annum. Since very little is going into storage, and the total consumption for purposes other than nitric acid, manufacture has increased but slightly, if at all, it may be estimated that at least 1,000,000 tons of nitrate per annum are being converted into nitric acid at the present time. This is equivalent to 650,000 tons of 100 per cent. nitric acid, of which nearly five-sixths is being used for the manufacture of military explosives.

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J. H. Williams & Co., makers of Superior Drop-Forgings and Drop-Forged Tools, with works at Brooklyn and Buffalo, N.Y., have just issued a catalog—4x6—106 pages, fully illustrating and describing their standard stock specialties. These include several lines of new goods, viz: "Agrippa" Turning-Tool Holders, Set Screw Pattern, "Agrippa" Boring-Tool Posts, "Vulcan" Forged Cutter Tool Holders and several new assortments or sets of Drop-Forged Wrenches. The book contains, also, a description of the drop-forging process in very simple, non-technical terms for the benefit of those not conversant with its details.

The American Steam Conveyor Corporation, Chicago, announces that the Atlas Machinery and Supply Company are now handling the sale of the American Steam Ash Conveyor in their St. Louis territory. This company has offices at 1416 Syndicate Trust Bldg., St. Louis, Mo., and is a new sales organization in that vicinity.

It is headed by Mr. Wm. H. Patton, who recently returned to the United States after two years' service in the army, during which time he was in nine branches of the service, gaining experience of great practical value.

The Link-Belt Company have issued Book No. 375, dealing with labor-saving elevators and conveyors. Bag pilers of various types are shown together with bag conveyors and telpherage systems. Bale and barrel handling equipment is also described, together with conveyor systems for other forms of containers, such as bottles, rolls, bags, etc. Book No. 380, also just recently issued, deals with electric hoists and overhead cranes. This book is also fully illustrated and descriptive of the use of this class of apparatus in general industry.

COMMISSION OF CONSERVATION, OTTAWA

[Tenth Annual Report]

Students of Canada's resources and of the problems associated with their efficient development will find a serviceable addition to the literature on this subject in the tenth annual report of the Commission of Conservation.

A concise review of the year's work is furnished by Mr. James White, assistant to the chairman. A series of unusually informative contributions includes "Housing, Town Planning and Municipal Government," by Mr. Thos. Adams; "Medicine in War," by Dr. C. A. Hodgetts; discussions of various phases of forest conservation, by Mr. Clyde Leavitt, Dr. C. D. Howe and Mr. Roland D. Craig; and of agricultural investigations, by Mr. F. C. Nunnick. Particularly timely studies of the water-power and fuel situations in Canada are presented by Messrs. Arthur V. White and Leo G. Denis.

This publication will not disappoint the very wide circle of readers to whom it affords an instructive annual resume of problems and progress in respect to the intelligent use and study of our natural resources.

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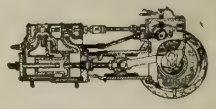

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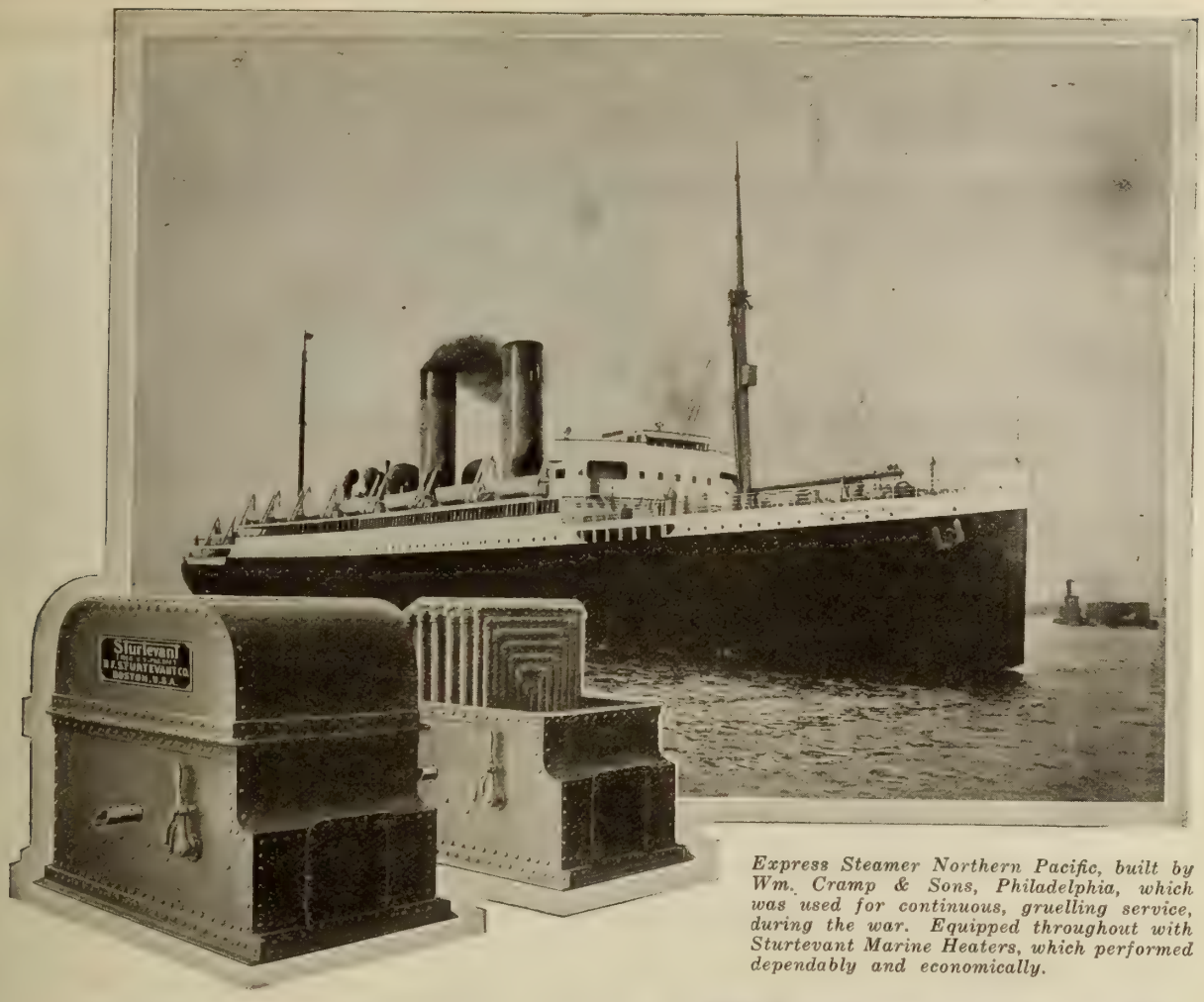

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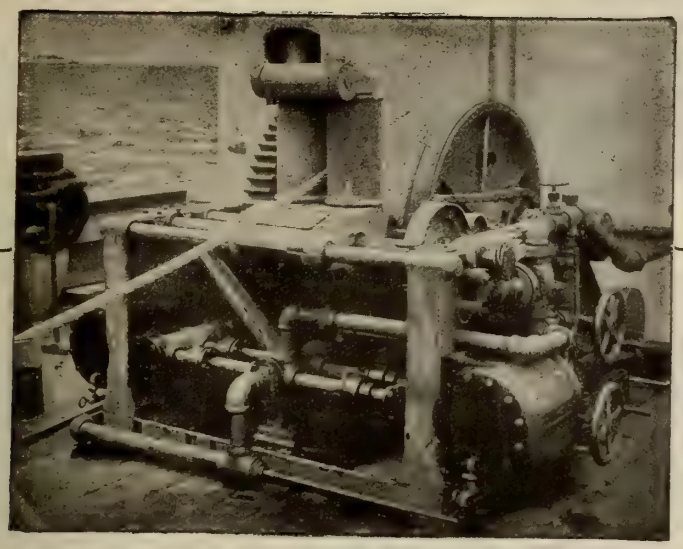

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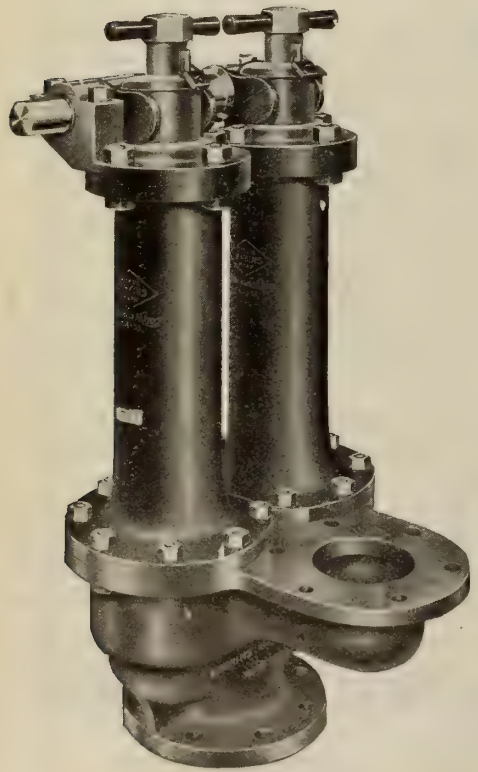

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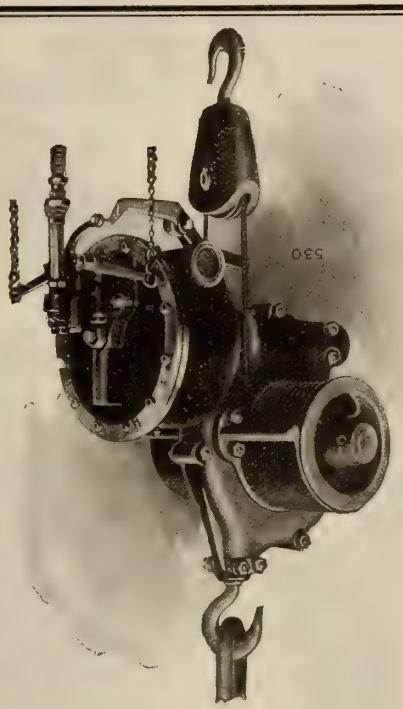

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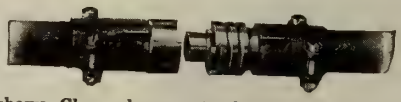
AIR  TIGHT

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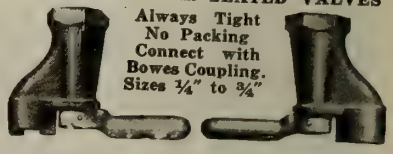

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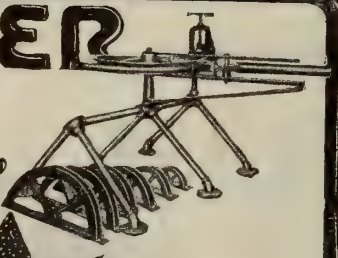

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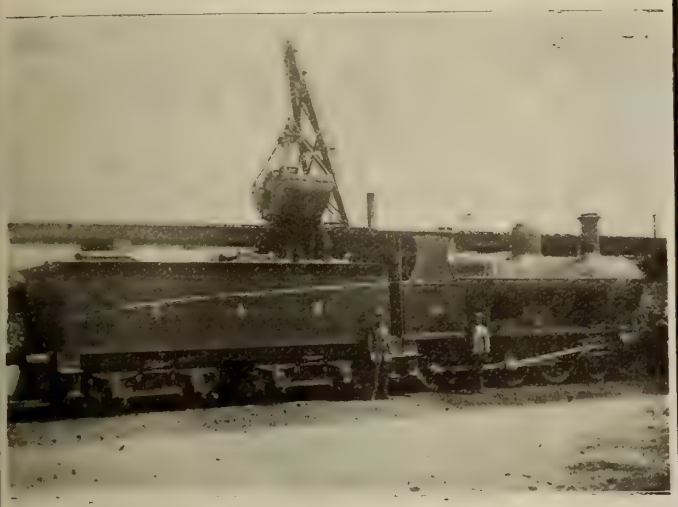

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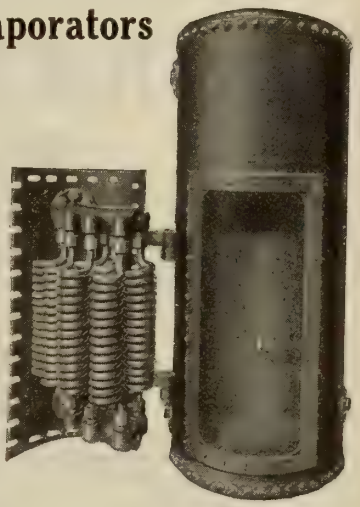

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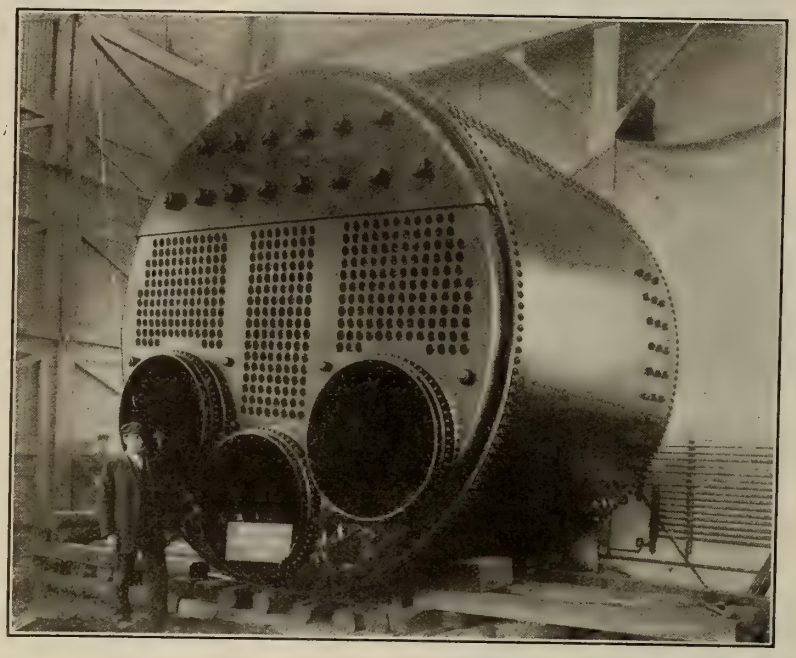

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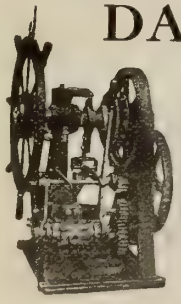

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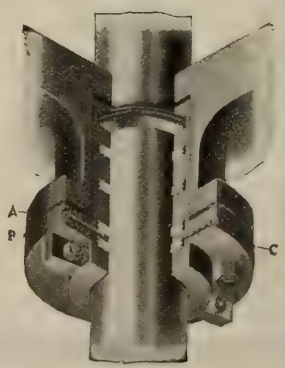

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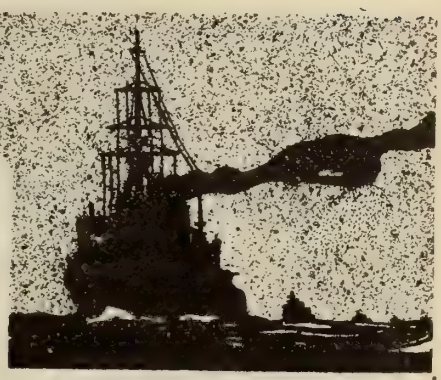

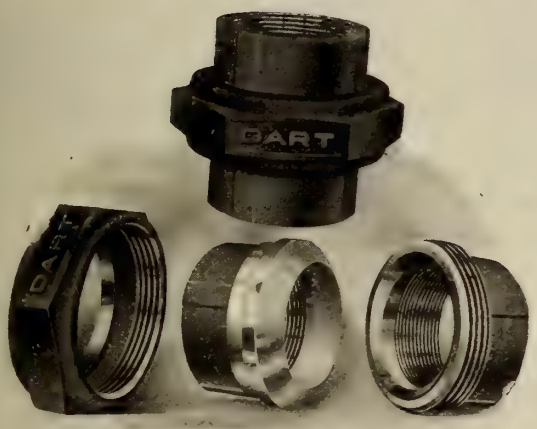

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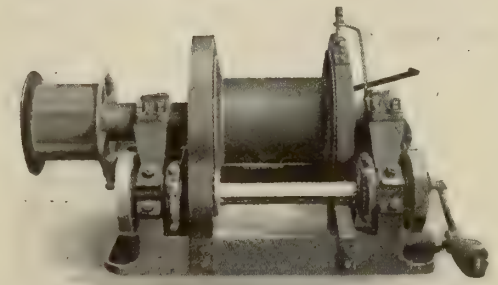

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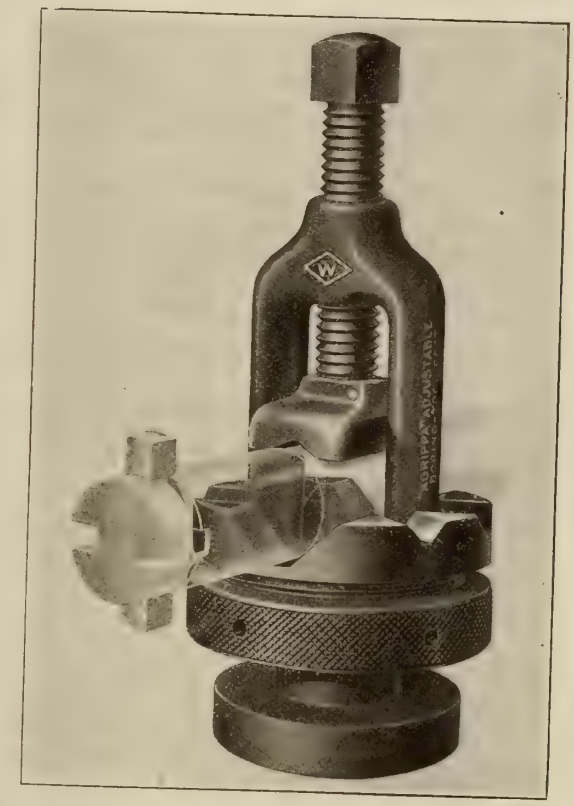

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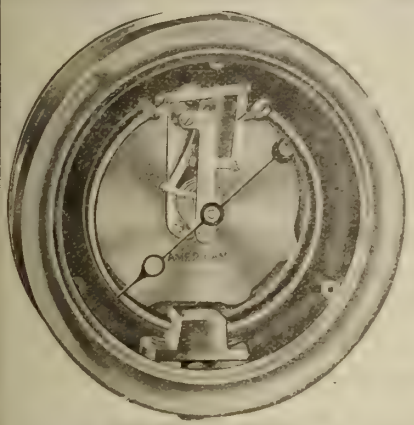

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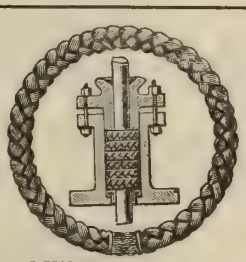

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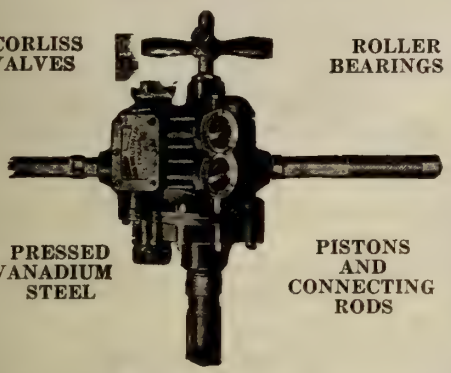

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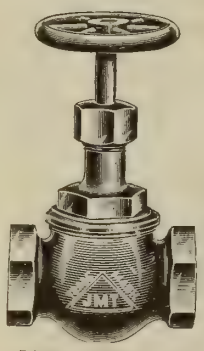

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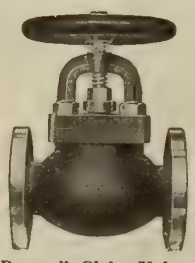
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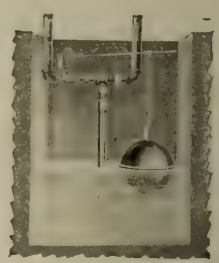
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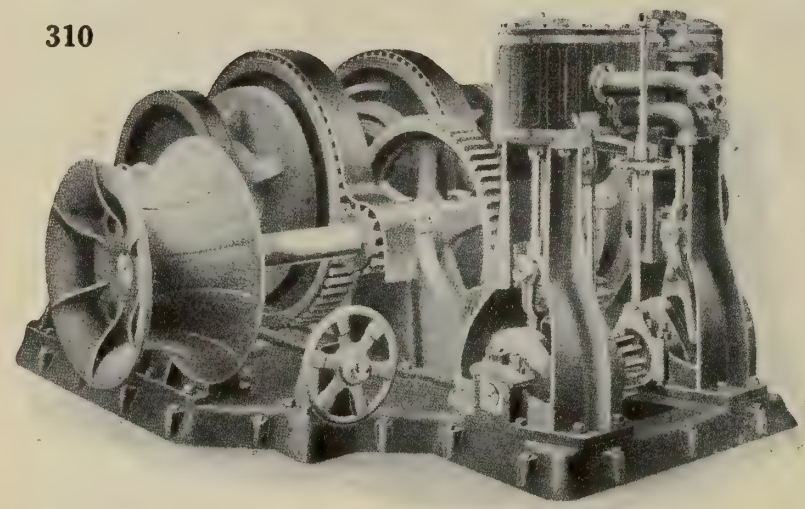

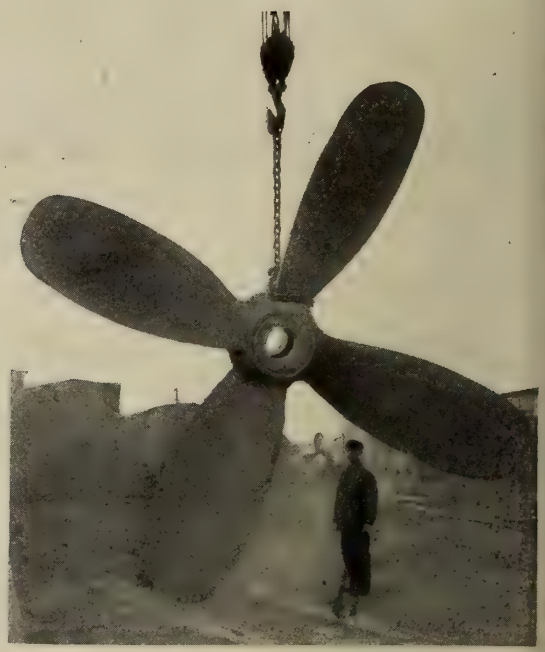

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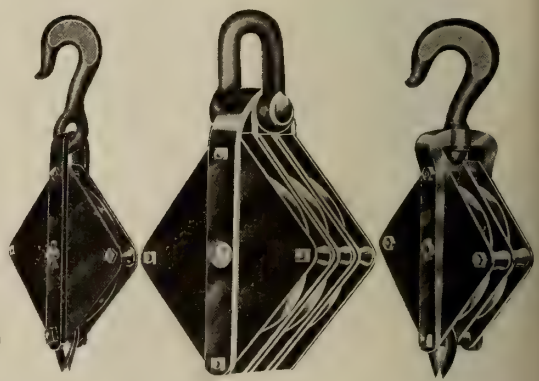

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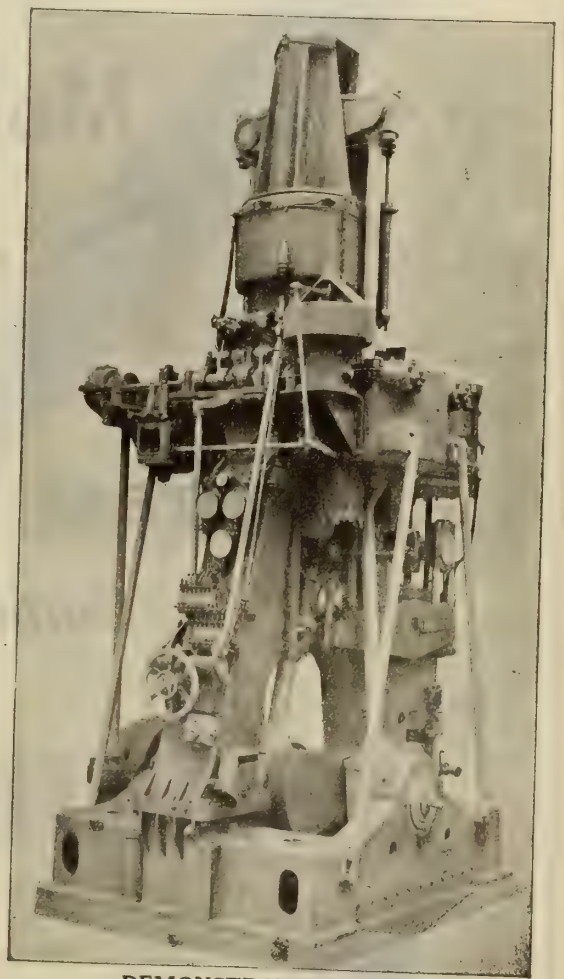

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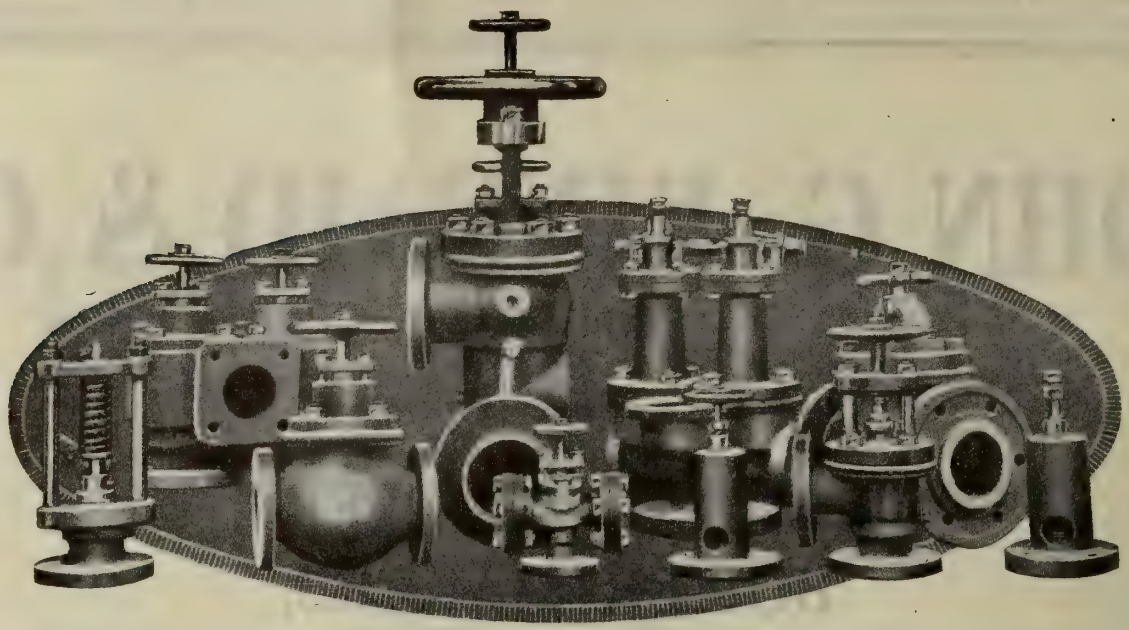

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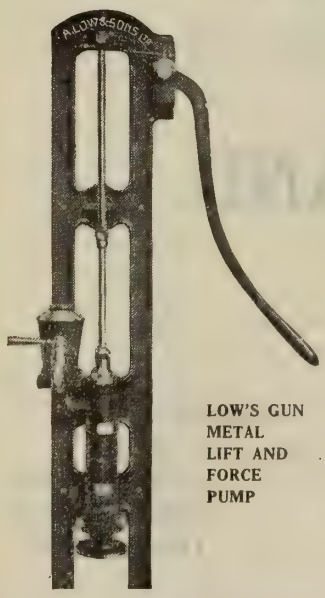

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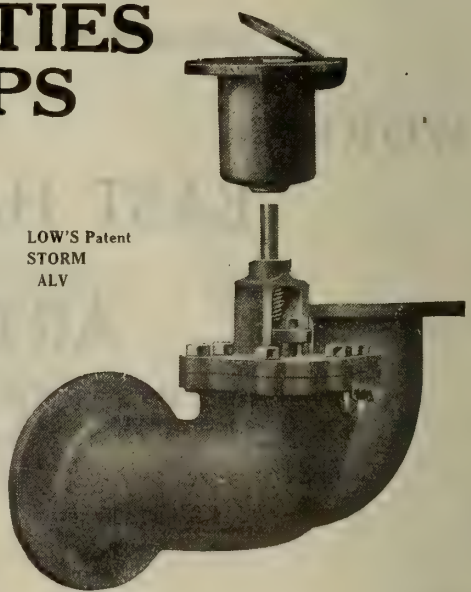

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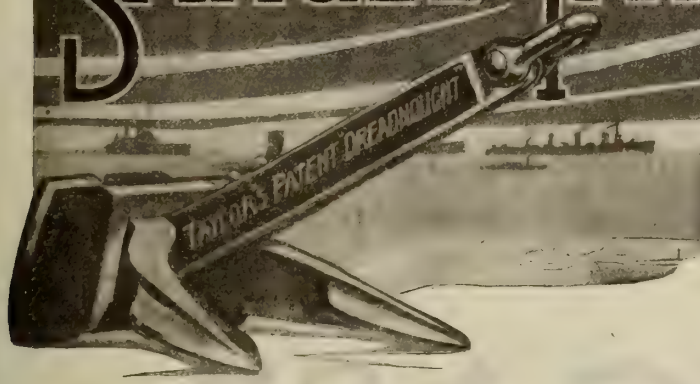

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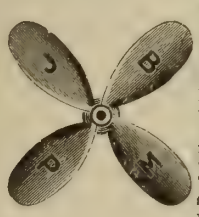

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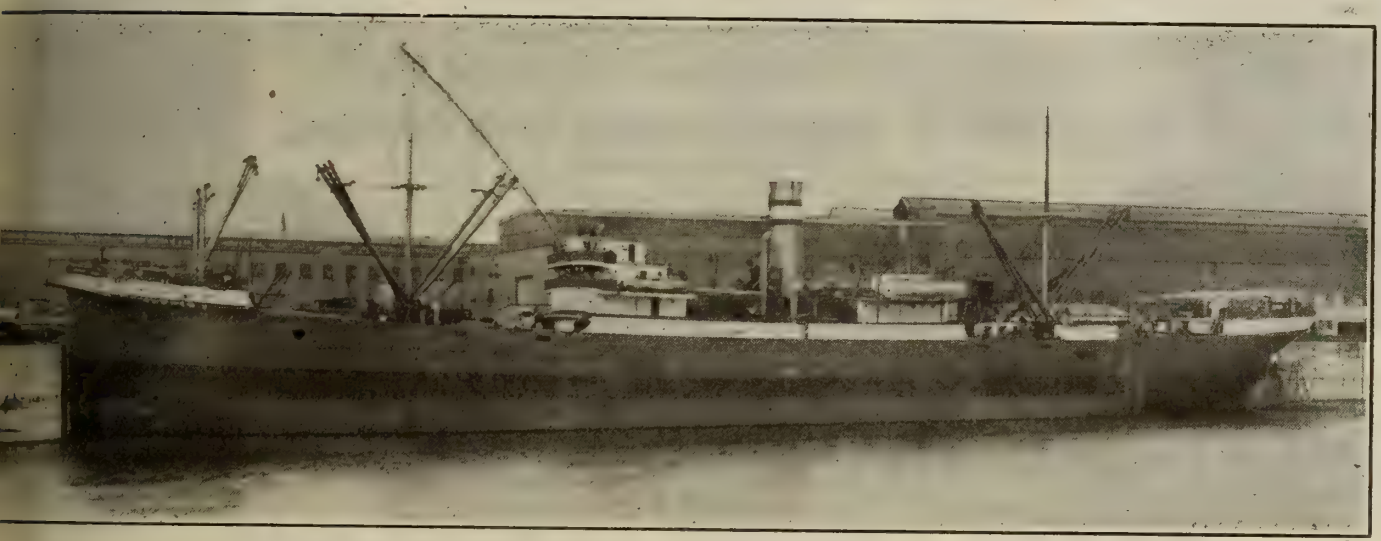

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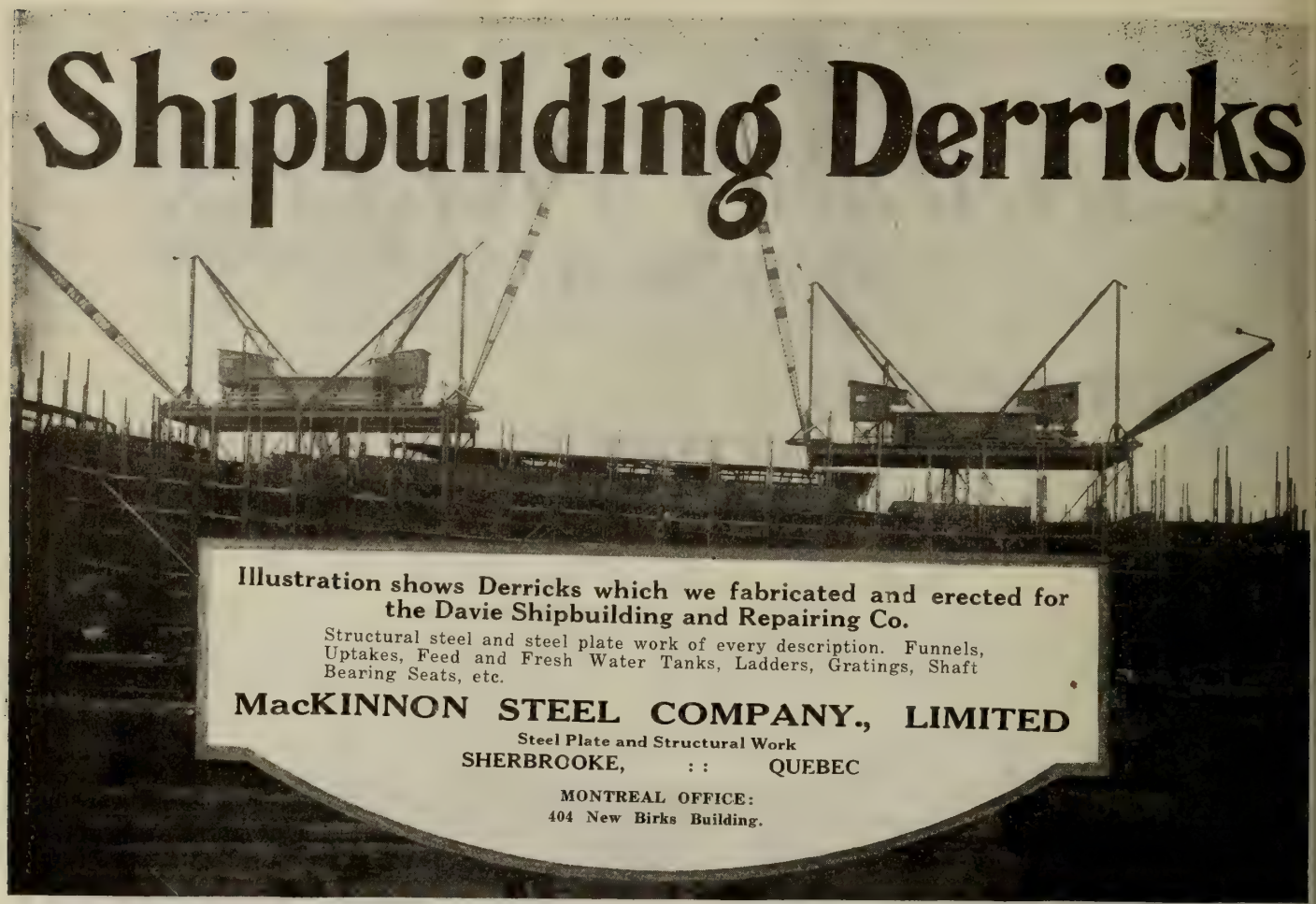

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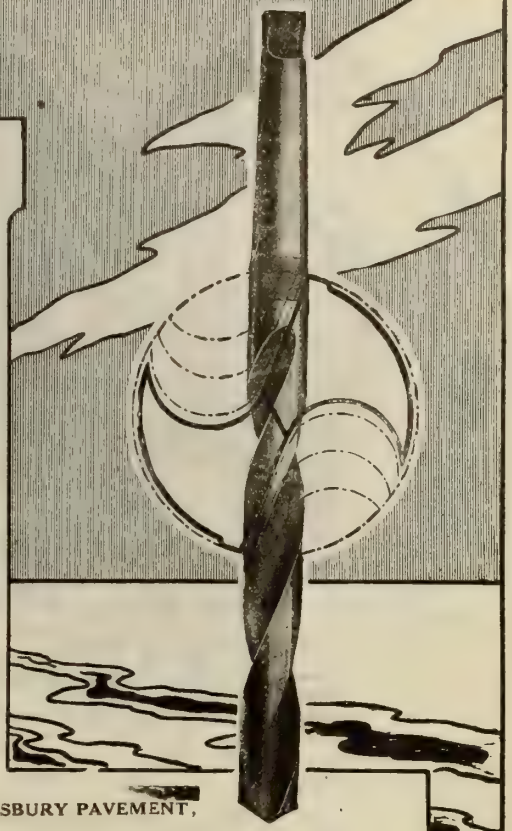

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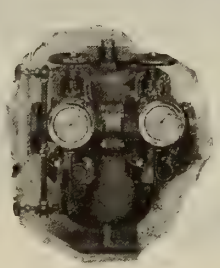

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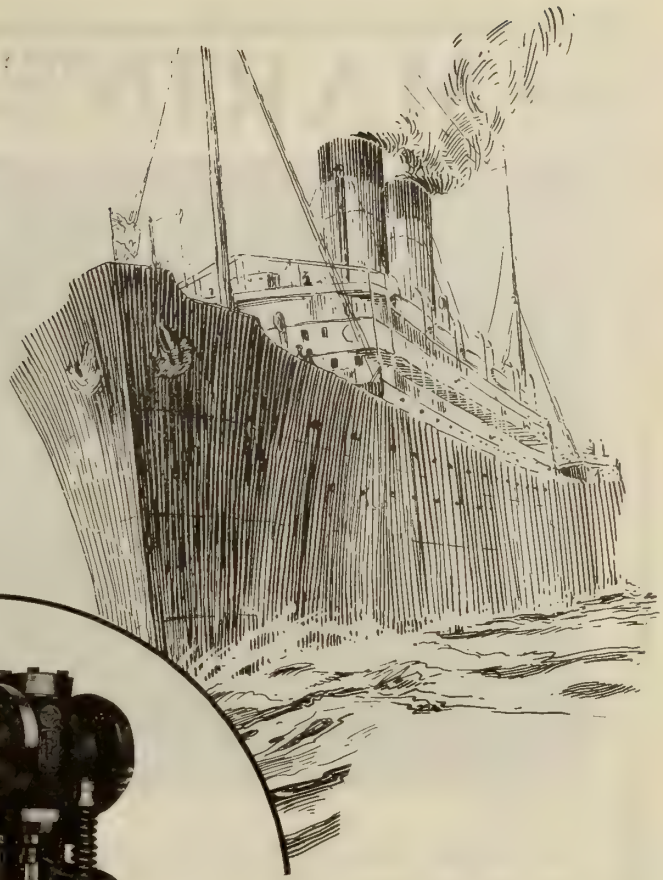

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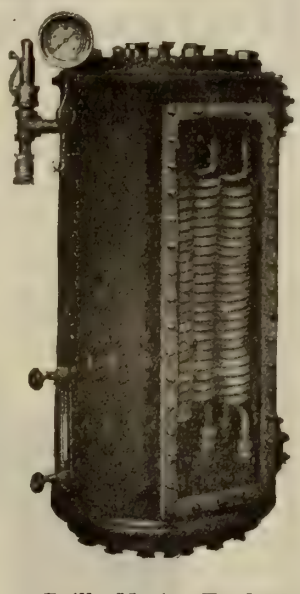

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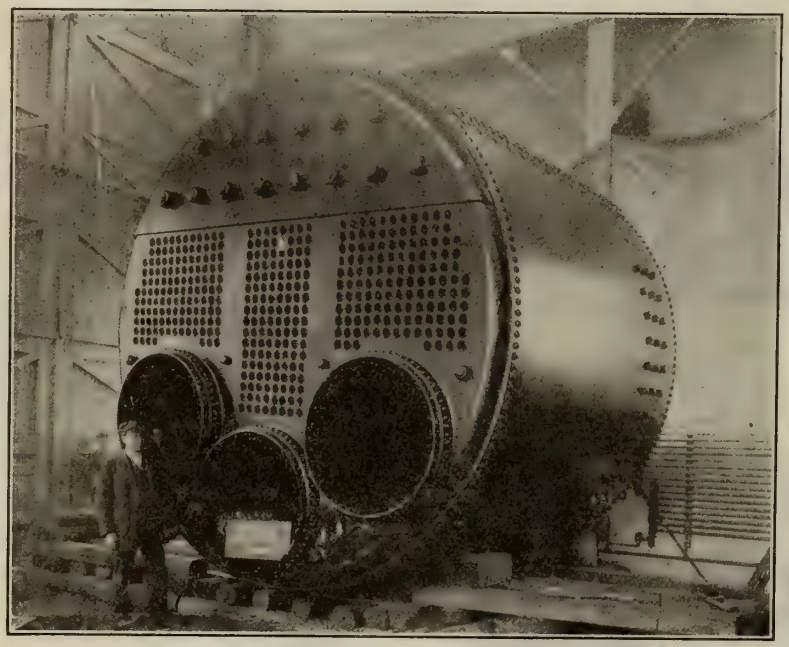

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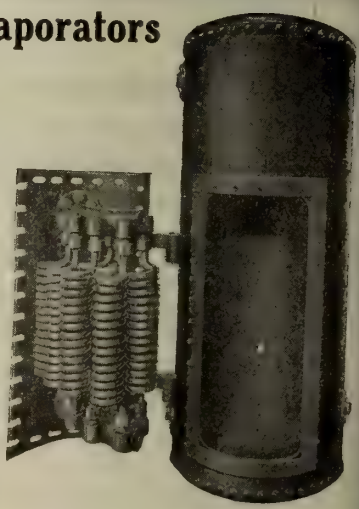

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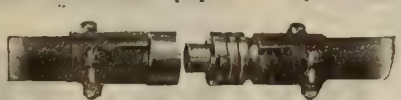
AIR  TIGHT

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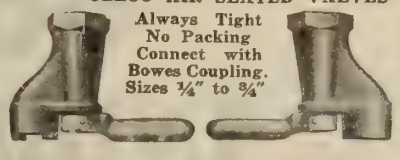

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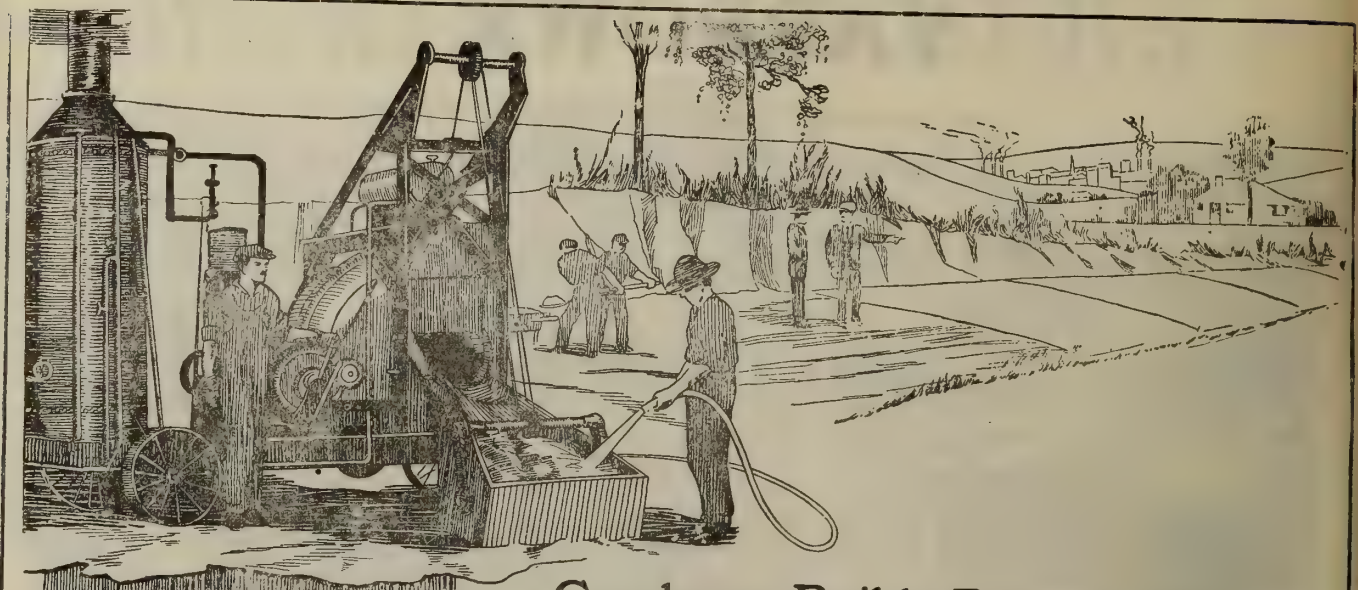

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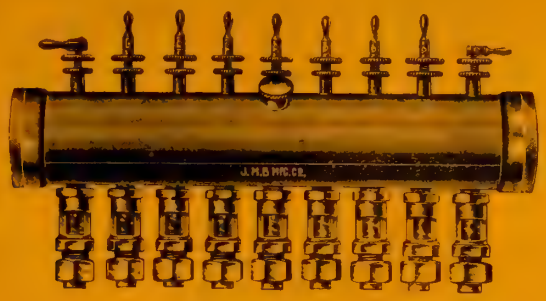

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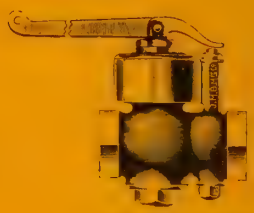

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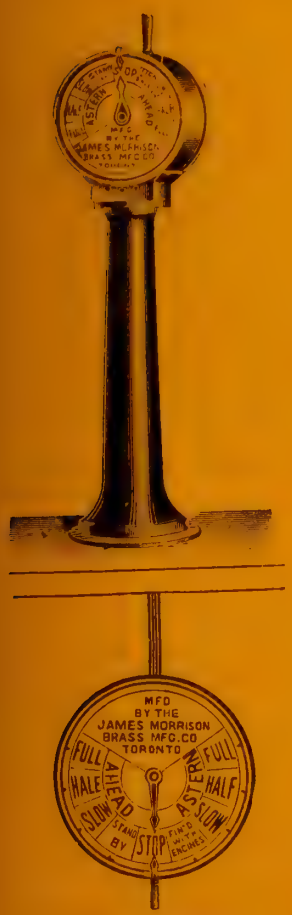

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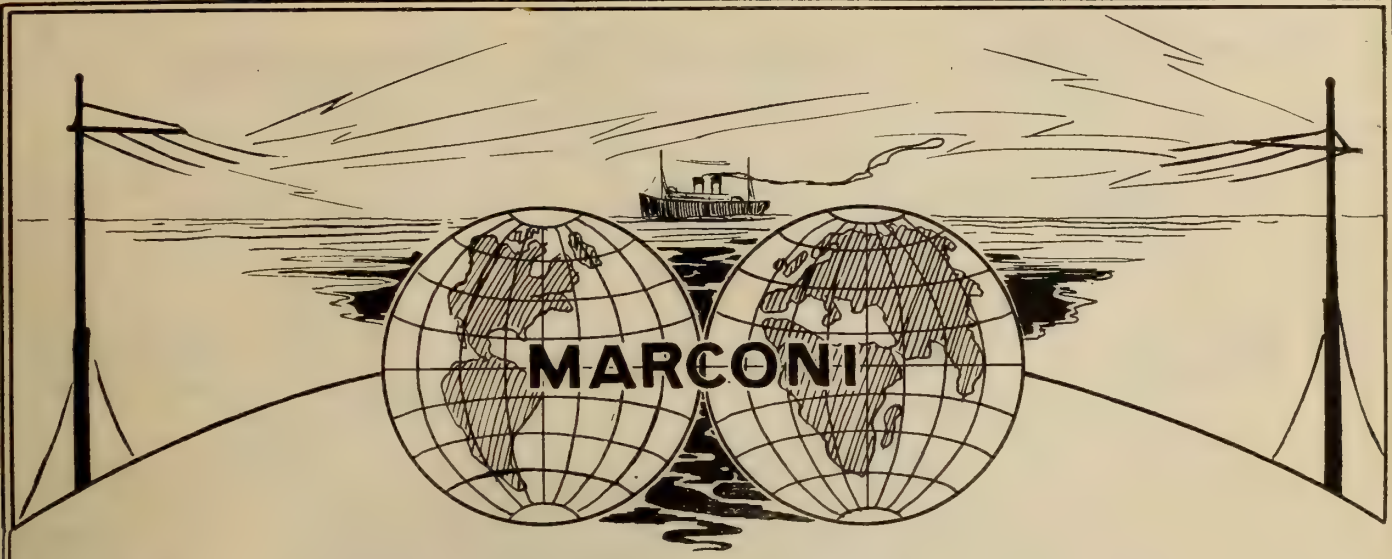

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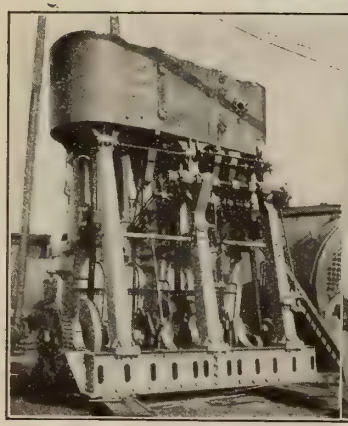

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The General Survey of Engines and Boilers

This Article Deals in a Descriptive Manner With the Work Necessary to Put a Ship's Engine Through Lloyd's or Board of Trade Survey

By T. H. FENNER

THE ship was coming up channel, homeward bound from Buenos Ayres, and all hands were looking forward to a good time in the home port. Sitting round the mess room table after dinner, the chief engineer remarked casually to the second, who was preparing to go below and resume his watch: "There won't be much time off for you boys this trip." "How's that, sir?" queried the second. "Well, we are due for general survey, and if they decide to give it us, we will be kept pretty busy." They knew he spoke truly, but there was nothing to do but wait and see what the orders would be when they reached port.

They docked about six o'clock the following morning, the final order and "finished with engines" being rung down at 6.30. Fires had been pretty well burned down, and the second turned the donkey man on to getting his donkey boiler ready and told his own watch to clear up the stokehold, and then knock off for breakfast. The fourth engineer was ordered to fill the boilers from the reserve tank and see that the fires were left so they would not burn up, and the steam sufficiently low to ensure the safety valves would not lift. In order to work the steam off to some extent the fourth was ordered to pump all bilges out. The third having been on watch till four a.m. had not been called, but was allowed to finish out his morning nap. The second, after a final look around, sent orders forward by the donkey man for all hands to turn to after breakfast and wipe down. Before coming up to breakfast the fourth had to go down the tunnel and see that the stern gland was tight, removing the syphons from the tunnel bearings at the same time. The greaser on the second's watch had been busily employed in taking out all the main engine syphons, cleaning out swab pots, and putting oil cans and swab brushes away in the store.

At 8.30 the chief and his three assistants sat down to breakfast, and immediately the second enquired if there were any orders yet. No, nobody had heard any news so far. Halfway through breakfast, a boy comes into the mess room with letters for the engineers that had been addressed to the owner's care. Perusing these occupies the remainder of the breakfast interval, and then the job of wiping down commences.

If there is one job that a seagoing fireman approaches with pleasure, it is this one of wiping down in the home port. When that is finished he is also finished, and free to don what go-ashore clothes he may still possess, and sally forth in search of the house that sells the biggest beer in town. He will be paid off the following or probably the same day, and credit is his for the time. Therefore, all hands eagerly besiege the storekeeper for wash and coal oil, and under the watchful eyes of the second engineer, get busily to work.

As steam must be kept on the main boilers till it is known definitely what is to be done, and, furthermore, for port uses till the donkey boiler is ready, the donkey man banks the main fires. He does it very, very lightly, so as not to waste coal, and also to make them light as possible for pulling out, when the time comes. The steam will be on the fore and aft winches, where the second and third mates, assisted by the bo's'un, will be rigging booms, preparatory for cargo work.

However, to come back below where we belong. The storekeeper is busy handing out the kerosene or coal oil (as taste dictates), and coarse waste. Fine waste will be used for the final touches, but the cheaper and coarser material does for the heavy grease. Wiping down, as its name would imply, simply means cleaning all superfluous grease and oil that has been accumulating on the 25 to 30 days' run home, and leaving the engines and engine room spotlessly clean. Three or four men are sent on to the top platform, where they immediately start cleaning off the cylinder covers, the bright work of which has been covered with a mixture of white lead and tallow, or bathbrick and soft soap, to prevent rusting on the homeward trip. Another group are put on the middle platform to start from the bottom cylinder head and work down; a third group sent to the pumps and back platform; and one or two down the tunnel, if there are enough. The third engineer is looking over his tackle in the store room, and thinking of his girls, while the fourth is occupied on odd jobs round the engine room, and wishing he hadn't spent so much money in Buenos Ayres. The second has gone on deck after getting the men well started, and is now in consultation with the chief. The chief is anxious to get to his home, a few miles away, and the second is anxious for the chief to go and come back, so that he can get off. However, if the survey is to be held, neither of them can get away till it is over. The third and fourth may be natives of the ship's home port, or perhaps come from some town a long distance away. As they are going back in the ship next voyage, they must stand by till all the overhauling is done and take the chance of a trip home. With all these little touches of "human interest," as the cub reporter would describe them, the shipowner is not the least bit interested. He knows the ship is due for general survey, and the only thing he is concerned with is to put her through in the least possible time, and with the least interference with loading and unloading. He, therefore, consults his marine superintendent and superintendent engineer, and they decide on the course to be pursued. The results of the consultation become evident on board by the skipper sending for the chief engineer and imparting to him the information that the general survey will be held. The superintendent engineer arrives shortly with more definite information, and the second engineer informs his juniors that the ship will be paid off at 2 o'clock that afternoon, and work started next morning. They can have the rest of the day to themselves, so they depart joyously to tread their native soil for a little while.

The men are through by this time, and the second gives instructions to the shore donkey man, who has come aboard

to relieve the ship's donkey man while he gets paid off, and gets over his celebration, if that way inclined.

By this time the donkey boiler is ready to be cut in, and the main boilers are shut off, fires drawn, and dampers closed. The second then feels that he also may call it a day, and the shore donkey man is left in charge for the time being. Of course, there is supposed to be an engineer aboard, but this rule is not always strictly enforced.

The General Survey

The general survey, as far as the engine room is concerned, is a very thorough examination of all the salient points of the ship's main machinery from main boilers to tail-end shaft. It entails a large amount of work, and also considerable time, and in order not to conflict too much with the commercial operation of a ship, it is sometimes carried out in instalments. However, in the case we have in mind, we will assume that the whole survey is carried through at once, the object of this story being to instruct those who have not had the experience, particularly the younger generation of marine engineers, who will have this to go through for the first time.

In the ordinary tramp steamer of 5,000 to 6,000 tons, the 2nd, 3rd and 4th engineers have each their regularly defined duties as regards overhauling work in port. The second, besides exercising a general supervision of the work, takes in his own individual charge the boilers and the cylinder tops. This includes the opening up, cleaning, and closing up of the boilers, and the overhauling of pistons and slide valves.

The third has charge of the main engine overhauling, which includes the main bearings, top and bottom ends, air pump links, valve gear, and glands.

The fourth takes the overhauling of valves on the boiler top, the auxiliary pumps, evaporator, feed filter, dynamo, and bilges.

In going through the survey all hands will be fully occupied. Take the boilers first of all:

Getting the Boilers Ready

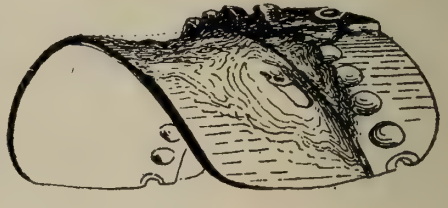
The first thing naturally is to empty the boilers. Engineers have different ways of handling this job. The steam may be worked down till there is just enough pressure left to overcome the head of water over the blow-off cock, and the boilers blown down gradually, care being taken to see that the cocks are shut in time to prevent the sea water rushing in. Another method is to let the pressure down slowly, and keep the donkey feed pump circulating the water in the boiler till all steam is off, when they are drained out into the bilges. Still others allow all the pressure to die down, and drain the boilers into the bilges, which are then pumped out. In some cases the top manholes are knocked in once the steam is off, and the boilers drained down, at the same time washing down with a hose as the water recedes, thus preventing the sediment in the water from sticking to the hot plates. The great objection to blowing down is that the matter held in solution in the water bakes on the hot plates as the water leaves them and is then difficult to remove. Of course, when time is the essence of the contract, blowing down is the only course available. Before knocking in manhole doors it is most important to make sure that there is no vacuum in the boiler, and in order to determine this, the drain cocks on the gauge glass and water columns are left open. The air can be plainly felt rushing in through these cocks until equilibrium of pressure with the atmosphere is established within the boiler. Once this is obtained, the bottom doors can be knocked in, and any remaining water lying in the bottom of the boilers below the level of the doors either drained out or baled.

While these preparations are being made the staging has been rigged in the stokehold plates for cleaning tubes. The smoke box doors are lifted, the retarders removed from the tubes, and the men are put on to sweep tubes. Retarders are long strips of galvanized iron, twisted into a long spiral, and are inserted in the lower rows of tubes. The idea is to give the gases a longer distance to travel in their journey from combustion chamber to smoke box, and thus give up more of their heat before reaching the smoke stack. The ashes are cleaned out of the furnaces both above and below the grate bars, and the refuse is hoisted up the ash-shoot and deposited usually on the main deck at the break of the bridge, as there are usually port regulations against dumping ashes overboard while in the dock or harbor. By the time tubes are swept, ashes sent up, and the stokehold cleaned up, the boilers will be cool enough to get the men in.

Before the men are put in, a careful examination of all valves must be made to insure that they are tightly shut, and strict instructions given against anyone tampering with them. In some ships the valves are padlocked, as there have been some distressing accidents, due to carelessness with steam valves when men have been inside the boilers. The writer remembers a case in Liverpool where four boiler scalers were scalded to death through this cause. In this instance the men were in the starboard boiler, while steam was on in the port boiler. The donkey man, through some incredible lack of memory, opened the auxiliary stop valve on the starboard boiler, admitting steam from the port boiler, with terrible consequences. The careful engineer will guard against such accidents.

Before anybody else enters the boilers, the second engineer dons his boiler suit and makes a careful examination of the condition inside. Armed with this knowledge, he instructs the boss boiler scaler as to what parts he must pay particular attention to. Boiler scaling is usually taken on contract, and the contractor employs boys, hard bitten little devils, who can crawl through the eye of a needle, if necessary. Armed with their chipping hammers, scrapers, and duck lamps, they swarm inside, and sliding down between the rows of tubes, spread themselves over the furnace crowns and vigorously attack the then hard scale. Some of them will be busy scraping the combustion chamber sides, between the rows of stays, chipping combustion chamber tops, and scraping tubes. The firebars are removed from the furnaces, and other boys enter the combustion chamber interior or back ends, as they are called. These must be thoroughly cleaned out, and any deposits made through leaks from tubes or seams cleaned away till the metal is visible. The surveyor will take nothing for granted. He must be able to see. The fourth engineer will be busy taking down the safety valves, so that the valves' seats and springs may be seen. The check valve covers will also be removed and the valves exposed to view. The main stop valves will also be opened up for examination. The internal cleaning will take probably two to three days, according to the condition of the boiler. When all the chipping and scraping is through, the hose is taken up through the top manhole, and the boiler thoroughly washed out. The bottom of the boiler is baled out and wiped dry with old bagging, and the chief and second make an examination together. If the cleaning has been done to their satisfaction, then the surveyor is notified that the boilers are ready for him to inspect.

This inspection is a very thorough one, in which nothing is allowed to slip by. Entering the boiler by the top manhole, the surveyor first examines carefully the top and sides of the combustion chambers. He is looking for broken or corroded stays, bulged plates, heavy scale, or signs of grooving round the edges of the stays. He also examines the girder stays on the combustion chamber tops, with a view to discovering any defects. Likewise he looks carefully over the through stays that support the heads and examines the threads close to the nuts, and the head plates around the washers. Then he crawls down the wing, between the tubes

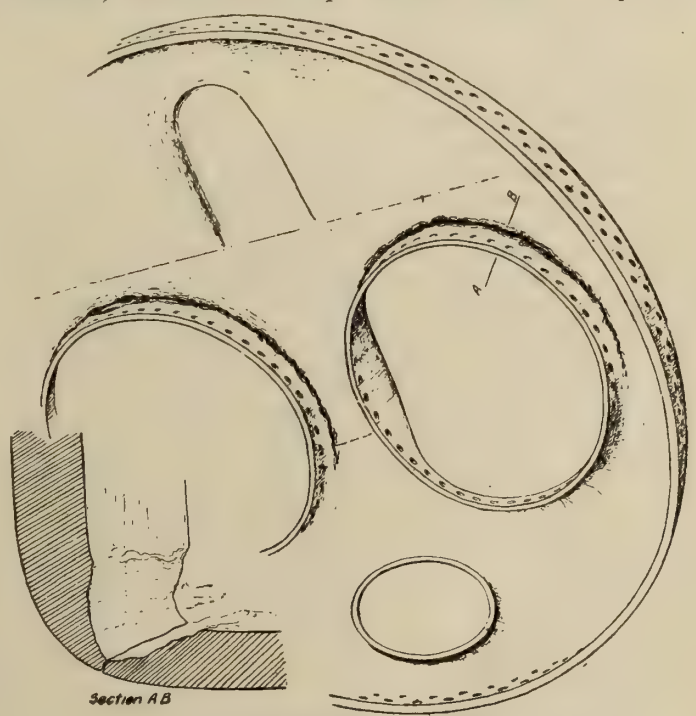


CORROSION ON A LAP SEAM

and boiler shell, till he reaches the furnace crown. Here he looks carefully along the line of firebars for signs of pitting, that insidious disease that is such a deadly foe of boilers. He sizes up the appearance of the furnace for distortion. Examines the seam where furnace and combustion chamber join for grooving. He looks carefully around the edges of shell butt straps for this same grooving, and goes over each furnace in the same careful manner. Finally satisfied that all is correct, as far as humanly possible to determine, he crawls out of the boiler and straightens himself out. His work is by no means finished yet. The next step is to enter the furnaces, and examine carefully round the bearers which support the firebars for evidence of corrosion from the hot ashes. He may also find pitting here, but more generally it is well defined wasting. In the way of the bridge wall he will also take careful stock, for these are places where danger lurks. Crawling onward, he finally reaches the combustion chamber, and examines every nook and corner of this interior, searching for evidences of weakness. Chiefly it is the inevitable corrosion he is expecting to find, and he may discover it as grooving round the edges of seams, or distinct wasting where some small leak has been at work. He will look also for cracks radiating from the edges of stay bolts, or from the outer edges of plates to rivet holes. He will spend quite a time in these back ends, for they are a very important part of the boiler, and a very likely source of trouble. Finally, he gets through, and is then ready to examine the fittings. He will examine the condition of the boiler blow-off cocks, gauge glass fittings, stop valves, safety valves and check valves, and after complimenting the chief on conditions, or leaving instructions for remedial measures, he will depart. Before leaving he will probably fix the date at which he will return and test the boilers hydraulically. One other point he will have examined which we have not yet mentioned and that is the head of the boiler on the outside, between the manhole doors on the level of the floor plate. Corrosion often occurs here through failing to remove the damp ashes thoroughly after cleaning fires, and the only way to prevent it is to watch the firemen carefully at sea, and in port, to keep this part cleanly scraped and painted with a mixture of red lead and coal oil.

The remaining work on the boilers consists of closing them up and getting ready for testing. The making of the manhole door joints is a job usually looked after by the second, who, if he does not actually do it himself, sees it done. There have been many nasty accidents through the joints blowing out under pressure, and the stokehold filled with water at high temperature. The difficulty usually comes through the recess in the door, which carries the joint, being a poor fit for the spigot or flange on the boiler shell, the result being that the joint or gasket, gets moved out of place when the door is put on. The gasket is usually made from asbestos tape, 1 inch wide by ¼ inch thick, which is laid round the groove in the door, cut off the right length, and the ends scarfed and joined together, being secured by lapping with sewing twine. The face of the joint which goes against the boiler is well rubbed with graphite, so as to make it easily removed. The lower doors on, the hose is attached to the shore hydrant and the boiler filled nearly to the level of the top manhole, after which the top door is put on, and the boiler pumped full, a cock being left open at the highest level to allow the air to escape. Of course, the valves which were opened up have been put back ere this, and the next step is to put the brackets on the safety valves. These are simply clamps which hold down the valve spindles, so that the valves cannot lift. They are used in preference to screwing the springs down far enough to get the necessary compression. When all is ready, a moderate pressure is put on the boiler to make sure everything is tight, and then the boiler is ready for the test. The pressure usually employed by the surveyor is 1½ times the normal working pressure. Pressure is brought up by means of a hand pump, and when the desired amount is reached the pumping is stopped. Pressure should drop only a very slight amount while the examination is proceeding. The surveyor will enter the furnaces and also combustion chambers while pressure is on, and observe any slight leaks or signs of distortion. Before pressure is applied he may test the diameter of the furnace or furnaces with a telescopic gauge, and make a second measurement while the pressure is on. Any alteration will be noted, and when the pressure has been released the gauge will be applied again, when it will usually be found that the original diameter will have been resumed. There is one more operation to be performed before the boilers are finally passed which is known as floating the valves, or testing the safety valves under steam. This, of course, does not take place till the boilers have been lighted up, and steam raised ready for sea. With fires bright and water at working level, the pressure is brought up gradually to the working pressure, the valves being screwed down if they lift before the

CORROSION ON A CORRUGATED FURNACE



GROOVING IN A FLANGE

right pressure is reached. When the compression nut is finally adjusted, split washers are introduced between the head of the nut and the valve bonnet to prevent any further compression being applied. A guard is also placed over the nuts sometimes to prevent them slackening back. The caps are put on and locked and the keys deposited with the captain. When all is adjusted, the valves must relieve all the superfluous steam with bright fires and all valves closed, with an increase over normal pressure of not more than 10 per cent. This test satisfactorily made, the work on the boilers is completed. In the meantime, of course, work has been going on in the engine room, which we will turn to next.

The Main Engines

The survey on the main engines consists in an examination of the main bearing journals of the crankshaft, the crankpins, cross head gudgeons, air pump gudgeons, interior of cylinders, and pistons, slide and piston valves. The thrust shaft is stripped and the tail end shaft will be drawn and examined. The vessel, of course, must be in dry dock for this latter operation, as the propellor has to be taken off.

The first procedure with the main engines, before any overhauling is done, is to put the turning gear in. As a matter of fact, this has to be done before the wiping down operations commence, as it is dangerous to allow a man to enter a crankpit without having the gear in. The turning gear consists of a worm wheel, keyed on the crank shaft between the after coupling and the thrust block. A small steam engine, with loose eccentric, so that it can be run in either direction, is placed close to it. This engine is vertical and carries a worm on the crank shaft, driving a horizontal worm wheel keyed to a vertical shaft. On this shaft is fitted another worm, which is capable of sliding up and down the shaft on a feather key. There is a slot in the shaft for the insertion of a cotter key. When the gear is to be put in, the engine is started running slowly, and the worm, which, in the out-of-gear position, is below the main worm wheel, is lifted up till the top thread engages the worm wheel. It will then work itself up precisely the same as a nut going onto a bolt, till it is fully in gear. The engine is then stopped, and the cotter key placed in the slot, holding the worm in place. Any further motion of the turning engine will then move the main crankshaft.

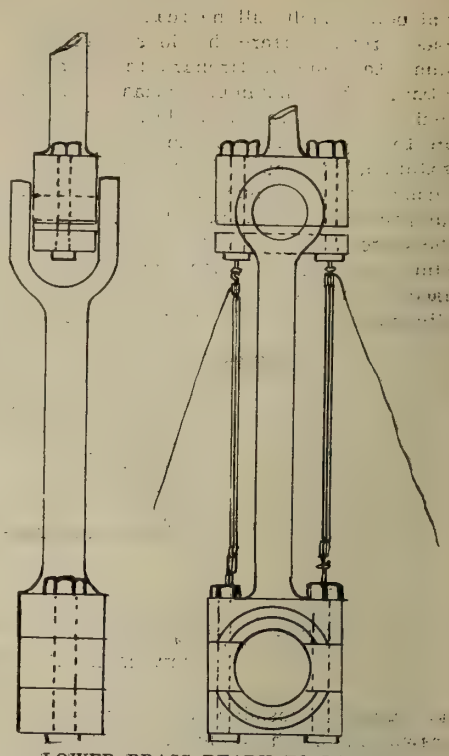
Another style of turning gear is worked from the reversing engine. A shaft, which can be thrown in and out of gear with the reversing engine crank shaft by means of a clutch, runs back to the condenser, where it is bevel-geared to a shaft at right angles, which drives the worm wheel through another gear. This gear is disconnected when not in use. The independent engine is the preferable one, because it is often necessary to work at the reversing engine at the same time that the turning gear is required.

The writer was in one ship where the turning gear was driven by a sprocket chain on the reversing engine, driving a sprocket geared to the turning wheel, and in another where the turning gear was driven by a sprocket chain from the ballast donkey on the back platform. This chain passed over about six guide pulleys before reaching the turning gear. In both these cases everybody but the man working the engine got out of the way when turning and it was not unusual for him to end up with seven or eight turns of the chain round him, and the engines unmoved.

Anyway, the gear is in, and the third is about to take down the high pressure bottom end. His first procedure is to either go aft himself, on deck, or send a trustworthy man to see that the propellor is clear. Neglect of this precaution has sometimes caused the depositing in the dock of a boat full of innocent painters, who worked on till the slowly moving propellor blade came up under their boat or scow and upset it. The onus in this case is on the ship, and I know of one case where a second engineer was offered the alternative of paying the damages or leaving the company's employ. He had neglected to see if all was clear before taking a turn out of the engines, and had smashed a boat and nearly drowned a man.

Having found all clear aft, he next makes sure all is clear around the engines, and starting up his turning engine, moves the engines till the high pressure crank is on the top centre. A man stands by and sings out when the desired position is reached. If the original crew are standing by the ship, the third will have his own greaser helping him, as he knows what is wanted, but even if it's one of the shore gang, the man will usually know the requirements. The first thing to be done is to hang the engine up. The method of doing this will depend on whether the engine is an open-fronted one or otherwise. An open-fronted job is one in which the front columns are round steel pillars, the go-astern guides being bolted onto the back columns. The closed-front type has cast iron columns front and back, go-astern guides being made on the front column face. In the first case the engine is hung up by removing one bolt on each side from the go-astern guides, and putting a steel plate across the face of the guide directly under the guide shoe of the cross head, securing it by replacing the guide bolts through holes in the plate. In the case of the closed front job there are usually one or two holes drilled in the go-ahead guide directly under the bottom of the guide shoe of about one inch diameter, into which pins are inserted, projecting out far enough to hold the cross head. The piston is thus prevented from moving down.

The next step is to screw two eye bolts into eyebolt holes drilled in the top end bolts. To these are attached two light tackles, usually known as pin blocks. In the top of the bottom end bolts are two other tapped holes, in which eyebolts are inserted. The blocks are made small enough to pass through the nuts, so that the bottom brass can be lowered right down to the crank pit when the nuts are slacked off. Before the nuts are moved, the third takes a hammer and chisel and marks the nuts and connecting rod foot with corresponding marks, so that he will know their position when setting up again. This done, the nuts are slacked off, a man is stationed at each pair of blocks, and the brass is slowly lowered, together with the cap and bolts, into the crank pit. The distance pieces and liners are tied together and placed in a safe place, usually the third's locker in the store. The brass is then lifted out of the crank pit and placed on the starting platform. The top brass is now to be removed, and this is a somewhat more ticklish job. The turning gear will be once more called into play. The third goes to the engine, or else sends the fourth there, and himself stays at the pin. The engine is slowly turned either ahead or astern, after the usual walk aft. As the pin turns away from the rod, the brass must be carefully watched in case it sticks to the foot of the rod. If it does, the turning gear is stopped and the brass tapped till it drops onto the crank pin. The engine is started up again, and the brass carefully balanced on the pin to keep it horizontal until the pin has cleared the rod sufficiently to allow of the brass being removed. When this occurs the tackle is hooked on and the brass swung out onto the platform. The under side of the foot of the rod, the brasses, bolts



LOWER BRASS READY TO LOWER

and caps are then thoroughly cleaned, likewise the pin, and they are ready for inspection. The same procedure is gone through for each bottom end, so it requires no further description. Lifting the main bearing caps is simply a matter of blocks and tackle. When the crankshaft is fully exposed the surveyor will examine the journals and pins, looking for flaws. These will be most likely to occur in the neighborhood of the fillets adjoining the crank webs. The pins will be callipered to determine their perfect rotundity, and the journals gauged to see if the shaft is in alignment. A spirit level is, of course, no use aboard ship.

We will describe putting the bottom end back and adjusting it, and proceed with the taking down of a top-end, or crosshead.

The top brass of the crank pin bearing is placed on the pin, and the engine turned back onto the top centre. The brass is carefully guided while this is being done, so as to come fair under the rod. This end is assisted by gently swinging the rod as the brass is coming under it, to prevent it jamming. All that is called for in this part of the job is careful manipulation. The top half being in its place, the tackle is rigged and the lower half, with cap and bolts, is lowered into position in the crank pit. The eyebolts have been left in place, and the pin blocks are rove through the nuts and bolt holes of the rod and hooked onto the eye bolts. The men heave away, and the engineer on the job carefully guides the bolts into the holes, taking particular care that the threads sustain no injury. The bolts are pulled up until the nuts can be engaged and screwed on three or four threads. The brass is left in this position, while the distance pieces and liners are put in the back side. Before placing them in the front side, the leads are laid in the bottom brass. These leads are just strips of lead wire which are laid on the brass concentric with it. Three are usually employed, one about 2 inches from each end, and the third right in the centre. When the brass is tightened up these leads will indicate the exact amount of clearance between pin and brass, and also if the bearing is equally tight all round. Sometimes a single lead is laid longitudinally in the bottom of the brass, when it is thought that the bearing has worn unevenly. To make sure the leads do not move while the brass is being pulled up, it is usual to place a little dab of tallow at each end of the wire, and perhaps another at the centre. The tallow flattens out precisely as the lead does when pressure comes on it and makes a good anchor while pulling up the brass.

When the leads are placed, the front liners and distance pieces are put in place and the brass pulled up into place. The nuts are tightened up to the marks at which they came off, and then as far beyond as they will go, with a 14-lb. hammer. The distance moved through past the original mark is carefully noted, and the nuts slacked back again till the brass is low enough to allow of the distance piece being removed, and the leads taken out. They will quite probably be found to be fairly equally flattened out over their entire length, though at the ends they will be slightly thicker than at the centre. This is as it should be, as the bearings are always eased a little at the sides. The leads will be gauged with a Birmingham wire gauge, or B. & S., according to the ship's nationality. Crank pin leads are usually set up to between 29 and 31. B.W.G. corresponding to 28 to 30 B. & S. gauge. If the first leads are too heavy, a thin liner is removed from each side of the pin, and the brass tightened up again. The nuts are hammered up as hard as they will go, and the position marked, the brass taken down and the leads again examined. They may now be too fine, but not so much so as to justify putting a liner back. Another set of leads are put in, and this time the nuts are tightened up to a position half way between the original marks and the last ones made. The appearance of the leads this time will be about right, and the bearing can now be adjusted to its working position. This is done by tightening up the nuts to the last position, and then trying the bearing with a bar. This is where the skill of the mechanic comes in. The bearings should be so set up that it will slide over the pin from side to side freely and without any slack. The nuts should be adjusted a small amount on each trial till the rod moves, and the adjuster should be able to just feel the brass moving. The operation cannot be described clearly. This knowledge only comes by experience. The ability to set up top and bottom ends so that they are as close as can be and still run is a matter of pride with every seagoing engineer.

(To be continued)

THE COMING OF THE MOTOR SHIP

Notwithstanding the numberless drawbacks attributed to the marine internal combustion engine by those not favorably disposed to this class of motive power, it is gradually forcing its way into the marine field in a manner that challenges the attention. Messrs. Harland & Wolff, the famous shipbuilders of Belfast, Glasgow, Liverpool and Southampton, are now turning out a set of motor ship engines every six weeks. The latest large vessel to be turned out is the motor ship "Glenluce," for the Glenn Line of Glasgow, and this is the seventh ship of this class and size built for the line. This looks as though the type must possess distinct advantages over the older and more-tried steam engine, for the Glenn Line are not the people to continue building these ships as a fad.

The "Glenluce" is a sister ship of the "Glenariffe" and "Glenade," and, as three similar ships, in every respect, are under construction, she may be taken as a standardized type. She has a deadweight capacity of 10,500 tons, and her engines are capable of driving her at 11 knots when fully loaded. She is 406 feet long by 54.2 feet beam, and her gross register tonnage is about 6,800 tons.

The engines are of the four-cycle, six-cylinder Burmeister & Wein type, and there are two of them, the vessel being twin screw. They run at 120 revolutions per minute, and develop 1,800 indicated horsepower each. The brake horsepower of the two sets is about 3,000. The cylinders are 26.375 inches bore by 39.375 stroke. High speed four-cycle Diesel engines are fitted in the engine room, direct connected to generators, which supply current for the auxiliary machinery. All winches, steering gear, and engine-room pumps are electrically driven. The injection and starting air for the main engines is furnished by three-stage air compressors, one for each engine.

The fuel consumption will be only 20 tons per day, which is highly economical for a ship of this size and speed.

Messrs. Harland & Wolff are building four motor steamers for the Glenn Line, of 13,000 tons deadweight, and fitted with engines of 3,200 I.H.P., giving a combined B.H.P. of 5,400, with a speed of from 13½ to 14 knots. They will have eight cylinders each, and will be the highest-powered engines of their type constructed. They are similar to the engines of the "Glenapp," but will have important modifications.

BOARD OF TRADE ANNOUNCEMENT

The Board of Trade have awarded a silver cup to Mr. John Bruce, D.S.C., skipper of the steam drifter "Pansy," of Wick, in recognition of the promptitude and ability with which he rescued the survivors of the steam drifter "Ocean Crest II," of Yarmouth, when that vessel struck a mine in the North Sea on the 19th November.

The Board of Trade have been informed by the Foreign Office that the Roumanian Government, in order to avoid being obliged to impose quarantine measures on travellers from countries in which plague or cholera has broken out, have requested the British and other legations in Bucharest to take the necessary steps to compel their subjects to give their exact address to the sanitary authorities at the frontier, and to submit, in their own interest, to medical supervision at their residence.

CORRECTION

Mr. W. B. Anderson, chief engineer of the C.P.R. steamer, "Princess Patricia," calls our attention to an error in the article on "Status of the World's Mercantile Marine." The date of the building of the "King Edward" should read 1901, instead of 1907. We thank Mr. Anderson for calling our attention to the error, which is a typographical one.

Pointers on the Solid Injection Diesel Engine

In a Paper Read Before the Institute of Marine Engineers, Mr. David P. Peel Gives Results of His Experience with These Engines

IN the course of a paper read before the Institute of Marine Engineers last week by Mr. D. P. Peel, he gave some interesting notes, based on the writer's experience with the Vickers' solid injection submarine Diesel engine. The different points were taken in the following order:

(1) Smoking; (2) knocking in the cylinders; (3) bearing lubrication; (4) cylinder lubrication; (5) the governor; (6) water cooling; (7) fuel; (8) setting sprayer valves; (9) diagram of operations.

Smoking.—There is no doubt that one of the greatest evils to contend with in this class of engine is smoking, the causes of which may be noted as leading to white or black smoke, the latter being more in evidence.

White smoke is caused by too much air, and is easily stopped by partly closing the air inlets or louvres in the air supply trunks.

Black smoke is more troublesome, as it may be caused in so many different ways, and consequently is much more difficult to locate the cause. It may be due to one or other of the following reasons:

(1) Too much lubricating oil supplied to the cylinders. When this occurs there is a tendency for the oil to deposit on the piston head, where, owing to the heat of compression, it partially vaporizes, and, the cylinder already having had its full charge of fuel, the added vapor being unconsumed passes through the exhaust as thick black smoke. The remedy for this is to cut down the lubricating oil carefully to the lowest point of safety.

(2) Where insufficient air is supplied to the cylinders the burning mixture will not be in the correct proportion for complete combustion when the fuel is injected, with the result that a certain quantity of fuel, although vaporized, cannot be burnt, and is passed off through the exhaust as black smoke. One cause of this may be the throttling of the air supply by the louvres, or, again, the passage of air may be restricted thus:—

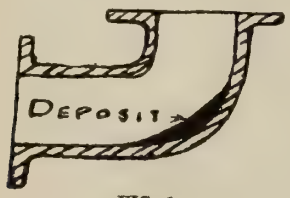


FIG. 1.

Where there are sharp bends in the air line, any dirt or dust, which must be drawn in with the induction, tends to lodge in those bends and, in time, forms a bar to the ingress of the air, as in Fig. 1, and thus the effective area of the inlet pipe is materially reduced.

This trouble is particularly prevalent where a pipe is led from the crank pits to the induction line, for the purpose of clearing the pits of any accumulation of explosive gas which may be generated by the running heat tending to vaporize the lubricating oil.

The air drawn in this way is generally of a greasy nature, and so assists to coat the pipes with dust which would otherwise pass right through the engine.

A grid or gauze is usually fitted in this crank pit induction pipe, but it is not sufficient to cleanse the air thoroughly in its passage through the inlet.

(3) If the fuel injection pressure is too low, then the oil, in its passage through the sprayer, is not properly pulverized, and so, not in a condition to burn readily, consequently a certain quantity of fuel just passes through the engine in a partially vaporized state, and is discharged as black smoke, so also if the pressure is too high a larger quantity of fuel is injected than can be burnt, with the same result. The pressure to give best results is about 3,000 lb. to 3,500 lb. per sq. in. The correct pressure is obtained by adjusting the lift of the fuel pump suction valve.

(4) A leaking sprayer valve has practically the same result as too high fuel pressure, and can be rectified by grinding in the fuel valve. The best grinding mixture for this purpose is smooth carborundum paste. When testing a sprayer valve for leakage, a maximum leak of one drop per minute at 5,000 lb. per sq. in. is permissible, but it is quite possible to get a valve tighter still within this limit for satisfactory running.

(5) The following has been cited to me also as a cause:—"If the maker's clearances were altered in the adjustment of the induction and exhaust valve lever push rods, there is a liability to smoking," but no reason was assigned. I investigated this on the engine I had charge of, and came to the conclusion—which may be open to argument—that the clearance between the push rod roller cam on this gear averages 30-1000 to 35-1000. Supposing these valves are set at 20-1000 instead, so as to reduce clash of gear, then each cam will pick up the push rod so many degrees before time and drop it so many degrees after time. Considering the fact that when the rods are set at correct clearance, the difference between the exhaust valve closing and the induction valve opening is only five degrees, it will be easily understood when the rods are set at 20-1000 instead of 30-1000 the induction valve will be opening before the exhaust valve is shut, and the engine being on the suction stroke, a certain amount of the exhaust gas is drawn back into the cylinders (Fig. 2), and being unfit for further combustion, occupies space in the cylinder that ought to be filled with pure air, and as the cylinder is still getting its full charge of fuel we have incomplete combustion, the unburnt fuel passing off as smoke. This is illustrated in Fig. 3.

Circle E is the clearance exaggerated with the radial line D marking on the clearance circle the point where the exhaust valve should shut, and the line B marking where the induction valve should open. If we cut down the clearance until the roller is on the line F, instead of the induction valve starting to open at B, it is starting to open at A, while the exhaust valve has still to go from A to C to shut.

Knocking in the cylinders.—At times we may hear alarming knocks in the engine due to one or other of the following causes:

(1) The packing of the sprayer valve may become hard and tight, gripping the spindles so that it cannot return to its seat after being raised by the cam, thus supplying fuel to the cylinder all the cycle. This will not do any damage on the exhaust and induction strokes, but on the compression stroke the charge is fired immediately the flash point is reached, the result being an enormous premature explosion, as this point is reached some time before the proper fuel injection time. This explosion puts a severe strain on the engine, not only towards reversing the direction of rotation against the normal, but also endangering the cylinder cover. The defective cylinder must be immediately cut off before serious damage is done, then slack back the gland of the sprayer valve, and get free movement on the spindle, after which the cylinder may be reinstated. Sometimes it is not necessary to overhaul the gland, as a few minutes idle running without the oil pressure in the gland will correct the trouble.

(2) The weakening of the sprayer valve spring will give similar trouble, as when the valve is lifted by the cam the oil pressure in the sprayer acting on the underside of the valve will not allow the valve to return to its seat, the pressure of the oil being greater than that of the spring in its weakened condition. The remedy is to increase the compression of the spring or fit a new one. In the former case care must be taken not to choke the spring, as the valve gear might be damaged by too much compression.

(3) Where the engine is so designed that when the exhaust and induction valves are full open, these project into the cylinder within the stroke of the pistion there is sometimes trouble owing to a deposit of carbon forming on the exhaust valve spindle; thus the spindle becomes so stiff in the bush

that the spring is unable to return the valve to its seat after being opened, and the valve head is struck by the piston on reaching the end of the stroke, and knocked violently to its seat. A little paraffin placed around the valve spindle will free it from the deposit and overcome this trouble. Fuel will suffice if paraffin is unobtainable; on no account must lubricating oil be used, as this aggravates the trouble. A weak spring is another cause of this knocking, making the action of the valve too slow.

(4) Too liberal cylinder lubrication is another source of mischief, as a certain quantity of the oil strays past the piston, and is vaporized and fired with the charge, causing a severe explosion.

Lubrication (bearing).—Any engineer will readily understand the vital importance of efficient lubrication, as a high-speed Diesel engine will not run many minutes if the lubricating system fails. The engineer ought to know the system so well that he can locate a fault at once, and perhaps save stoppage of the engine. By knowledge and study an engineer is often able to detect a coming fault and anticipate it. In the bearing oil system there are usually three sets of strainers and two gauges, one strainer in the end of the crank pit strains the oil on its return to the oil drain tank. A second is in the oil pump suction line between the tank and the pump suction valves. A third is on the delivery side of the pump to the engine. One gauge is combined pressure and vacuum, and is tapped off the line between the suction strainers and the pump. The other gauge, pressure only, is tapped off the line between the discharge strainers and the engine. By observation of these gauges and a knowledge of where they are tapped from, one can tell what is happening at any point of the oil system. As, for instance, knowing there is plenty of oil in the drain tank, on seeing both gauges register below normal, one may conclude the drain tank strainer is fouling, and immediately take steps to clear it. Should the vacuum gauge show at normal while the discharge pressure remains correct, then the suction strainers are becoming clogged, and it follows, if the vacuum gauge is normal and the pressure is low, that the discharge strainers require attention. If both gauges show low and all strainers have been cleaned, then sound the old drain tank, as a quantity of oil may have been lost through leakage. Some engines are fitted with a valve on the drain tank strainer to trap the oil in the crank pit that the drain tank may be cleaned. This valve is apt to be overlooked when starting up, and after a few minutes runing the oil pressure falls to zero as the drain tank is emptied into the crank pit; this may lead to shutting down the engine if the engineer is not immediately able to trace the cause of the loss.

Cylinder Lubrication. — There are many methods of cylinder lubrication, two of which I will deal with.

(1) A separate small pump is fitted for each cylinder and actuated by a small cam on a roller let into the ram head. The cam forces the ram down on the pressure stroke, a spring returning it on the suction stroke. According to the number of cylinders, so are the pumps arranged to work by suitable means from the main cam shaft. With these pumps the main trouble is the breaking of the return springs, in which event the ram remains at the bottom of the stroke. The pump is so fitted that a spring may be renewed whilst the engine is running. This class of pump requires a good deal of attention, as the valves are so small that the slightest particle of grit on the seat will put the pump out of action.

(2) An ordinary rotary cog pump may be fitted to supply oil to the cylinders through sight-feed lubricators fitted on each one, and practically the only trouble is the side wear of the cogs with consequent diminution of pressure.

The Governor.—In some cases of governed engines, where all the cylinder heads are coupled solid with each other, and the governor is fitted on the end of the engine supported by the end cylinder, I have found that, owing to the unequal expansion of the cylinder tops relatively to the bedplate when the running heat is attained, the governor shaft, if driven off the main shaft by bevel gearing, is liable to be thrown out of line, causing jamming of the bevel wheels, and gripping of the governor shaft in its bearings, resulting in damage to the bevel wheels and excessive overheating of the bearings. This may be overcome by scraping the bearings on the angle sufficient to allow for free movement when the engine is hot. This trouble is not experienced where the governor is in the centre of the engine and where the cylinders are quite separate.

The water cooling arrangement gives little or no trouble, but as a precaution in case of a leak into a cylinder, it is advisable before starting to turn the engine at least two complete revolutions by hand, or dead slow on compressed air, with all explosion cocks open, to see that all cylinders are clear. If water issues from an explosion cock, turning by hand will effect the desired end. No attempt should be made to start while there is the slightest suspicion of water or when the water system is charged with air, as there is a possibility of steam locks forming and stopping the flow of cooling water, which must be guarded against.

Fuel.—In the case of marine Diesel engines there is a possibility of getting water into the fuel tanks owing to the straining of the ship's plating in bad weather. It is best to keep a sharp eye on the gauge glass of the fuel gravity tank, and if any water shows, open the drain cock at once; this will assist to keep the water below the level of the engine supply pipe, which is fitted well up the tank, but in the event of water reaching too high another tank should be used for the time being till all is clear.

Timing Sprayer Valves.—There are two methods of setting the sprayer valves:

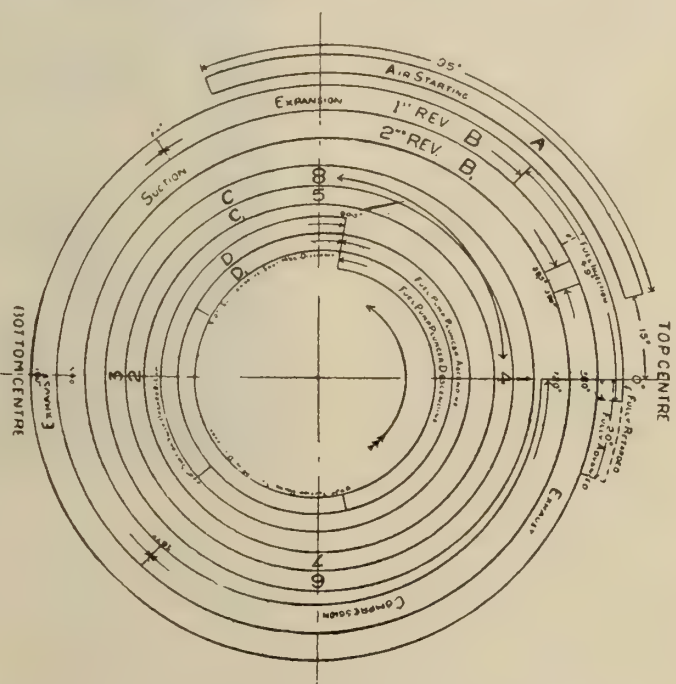


FIG. 2.

(1) Disconnect the fuel supply pipe to the sprayer valve, and then connect a flexible hose to the air starting bottles. Take out the explosion cock and turn the air pressure to the sprayer valve. When trying No. 1 sprayer engine fully retarded, that is, starting to open 4 degrees before the top centre, have the engine turned by hand in the direction of rotation dead slow, listen at

the explosion cock hole, and the instant the sprayer valve is heard to blow cease turning, and note on the flywheel graduations the number of degrees between No. 1 and the pointer fixed on the frame marked top dead centre; this number of degrees should tally with the 4 degrees, if not, the toe piece on the sprayer valve cam must be moved forward or backward as the case requires, and the process gone through again until the correct point is attained.

(2) Fig. 4 illustrates a sprayer valve (A) complete, B is the actuating lever, and C the cam with the toe piece (G); H is the valve spindle. The brass rod (D) is led through the cap (J), and insulated from it with the sleeve (E) made of non-conducting material, and screwed through the cap for fire adjustment. The rod (D) is set as close to the spindle (H) as possible without allowing an electric current to jump the gap. An electric wire (F) is led from the rod (D), and from the body of the valve to a lighting circuit or battery, with the lamp (M) in the circuit. The circuit is now complete except for the gap N. Let the engine now be turned by hand dead slow, and as soon as the toe piece (G) picks up the roller on the lever (B) the gap (N) will be closed and the circuit completed, lighting the lamp (M); then the flywheel graduations are noted as previously with the air. The disadvantage of the first system is the loss of starting air; the second is not so accurate, as the valve has to be raised a certain amount to close the gap before the lamp will light, when one degree or perhaps two will not be recorded.

Sketch 2 comprises a diagram of: A, air starting; B B_1, running cycles; C C_1, sequence of firing; D D_1, cycle of fuel pump of Vickers 100 h.p. unit engine with eight cylinders.

Standardized Motor Boats in the Navy

By Andrew Dyas MacLean (Late R.N.V.R.)

THE type of motor launch used by British Navy for auxiliary purposes during the late unpleasantness has been much lauded by the builders and the great pan-American press of the United States.

They claim to have evolved the first standard ship of any size that has been adopted in any number. Theirs is not a claim—it is an admission of guilt which is, however, commendable.

These little ships, equipped in every possible way to burlesque a real battleship, were of some 30 tons displacement, were 80 feet in length and carried 2,000 gallons of fuel.

They were standardized by our American cousins to such an alarming extent that on returning aboard late at night one was very liable to turn into a bunk on another ship; only realizing your mistake next morning at breakfast when the cook brought you coffee when he should have known that you always took tea.

The twin engines were of the six-cylinder variety, developing in the neighborhood of 250 h.p. at 350 r.p.m. The ignition was the reliable "make and break" low tension system which never failed to keep the two mechanics working several hours of their short "rests" in harbor.

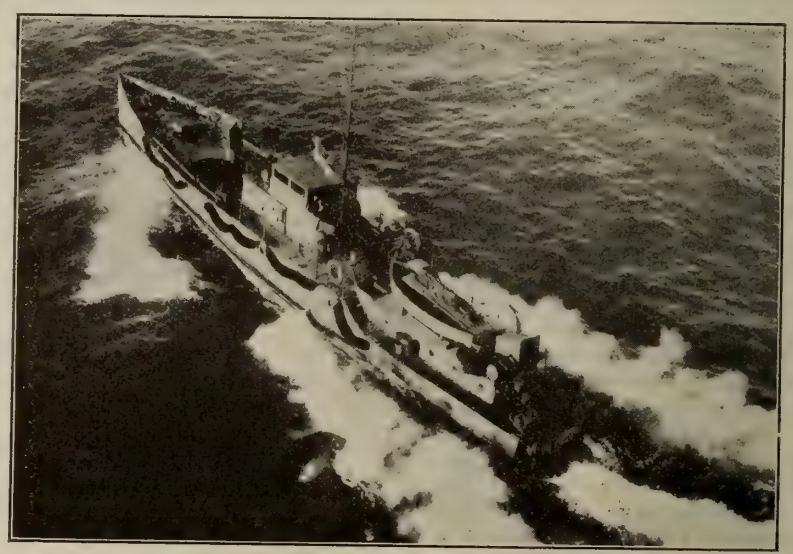
The drive to the propellers was direct—that is as long as the shaft lasted—for I have seen as many as four main shafts break among a dozen boats in one day's steaming.

The cam shafts were fitted with four sets of cams. One set for "starting ahead" consisted of an air valve cam for starting and another as half compression lifter for the exhaust valve. The second set of cams on the "go ahead" was the full compression running position. Two similar sets of cams were intended to give the engine a reversing motion.

It was found, however, that some of the cam shafts, at least, had been wrongly set and that to get the most efficient valve timing for high-speed work it is necessary to practically eliminate any real hope of reversing.

Compressed air in ample quantities, however, generally served to give a sufficient number of revolutions to check the way on the ship for coming alongside a quay.

The auxiliary engine was of the two-cylinder type with a large air compressor cylinder mounted on the same crank shaft between the two-power cylinders.



MOTOR LAUNCH UNDER WAY.

This crank shaft was coupled direct for the generator which supplied current for searchlight, signalling apparatus, exhaust fans and the conventional lighting and heating. Small storage batteries were sufficient for the ship's lighting and were used for starting the auxiliary engine by reversing the purpose of the dynamo.

To return to the propeller shaft troubles that frequently depleted the sea-going forces of motor launches as much as twenty-five per cent., it would seem that the engine builders were unaware that the hull in which their machinery was to be installed was built along non-rigid lines.

The engines themselves were bolted to heavy foundations, which, owing to the engine-room bulkheads or to economy, were not extended any distance either end of the engine bases. An intermediate bearing carried the weight of shaft between the thrust blocks and the non-aligning stuffing box. Two outboard struts or A brackets supported the shaft to the propeller. No flexible or universal joint was fitted in the entire installation. This arrangement may appear all right to the designer who is used to heavily constructed vessels, but in a lightly planked shell, especially one with a break in the deck line, it was most disastrous.

The shaft carried its own bearing surfaces where it came in contact with the strut bearing, etc. These heavy brass bushings were soldered to the sheath and after eighteen months or more serious corrosion set in, and if one of the bearings happen to run hard the solder would give way and the bushing remain staticnary while the revolving shaft soon wore away its protecting shield, and then of course it was leave for the ship's company until a new shaft could be procured.

The rudder, which was of the outboard type and practically unbalanced, worked in almost dead water between the slip of the two propellers, consequently nothing but a large helm angle was of any use. The Admiralty, owing to the rudders being secured only by light lag screws into the transom, had to almost rebuild the stern to prevent the rudder coming out by the roots when used for steering.

An able-bodied man could pull up any of the rail staunchions; they too had to be gone over and turned into some semblance of permanent fixtures.

Designed for in excess of 19 knots, it was possible in a few of the ships to obtain in excess of 16; in fact, so far were they below their guaranteed speed that it was necessary for the contractors to send their best mechanics across to England and for the Admiralty to commission a launch especially for these tests. This motor launch, which was commanded by Lieut. Bass Thompson, White Eagle of Serbia, Croix de Guerre, R.N.V.R., was in commission off Spithead and in the Solent for six weeks before the contract speed was attained. This contract speed was attained by this specially-operated launch, but the writer, in his eighteen months' experience afloat in these craft, has never seen anything like it logged, not even under the stress of action.

The large gasoline tanks were cunningly designed so that they could be neither inspected, cleaned, nor repaired without removing the decks. No filter or sediment trap was to be found at the outlet of the tanks, with the result that the fuel lines were continually becoming plugged, sometimes in most embarrassing circumstances.

In a head and a beam sea these little ships behaved very well if not driven hard. In a following sea—well, you never had a following sea if you could take it any other way! Much too buoyant aft to the "pooped," the little craft would bury her nose and race, shaking in every lath of her framework. To steer her was an impossibility even by using the propellers ahead and astern to assist the fountain-raising rudder.

EXPLODING A DEPTH BOMB.

There is one particular case that still remains clear in my mind. It was early in the summer of 1917 when the submarines were taking their greatest toll of merchant ships, and all available motor craft were drawn from patrol and other works to form "hunting flotillas."

My ship was stationed at Imkros, an island opposite the Aegean entrance to the Dardanelles, when a wireless message was received to join some other M. L.'s in a position some miles S.E. of Thaso. We arrived at our position without mishap, which unusual occurrence added to our suspicions that something unforeseen was perhaps to happen.

There were some seventeen motor launches commanded by a small monitor stretched between the islands Thaso and Imkros to intercept a Hun submarine that was reported steaming north to the Dardanelles.

As it was a perfectly calm night, all were stopped, and with their hydrophones hung over the side listening. With these underseas telephones it was possible to hear the engines, either surface or electric, of a submarine upwards of three to six miles away, to tell her bearing, and later, when a second reading was obtained, her approximate course and speed.

It was a little after the middle watch had come on deck bleary-eyed and white from the gasoline fumes continually given off from the tanks when the slightest roll agitated their contents, that we heard a Fritz.

He was just heard steaming on the surface about five miles away, and we counted his revolutions by the rumm-rumm of his cranks. He was doing nearly 200, I remember. When he was perhaps three miles distant we heard strange irregular tapping noises in the 'phones, and the drome of his surface engines suddenly stopped, to be replaced shortly by the steady hum of his motors as he ran submerged.

These tappings were a warning signal sent by the enemy to warn their submarine of the position of our forces. We followed the sound of his motors for several miles until a rapidly-rising southerly gale made the hydrophones useless through the water noises that a heavily-rolling ship causes. Since the weather favored the Hun and fuel and water was short, the flotilla, having been at sea some seven days, we headed for shelter some sixty miles to windward. We had gone but a few miles when both engines ceased to function and passed quietly into a motionless mass. We were then as the writers say, "At the mercy

SOME VIEWS OF MOTOR LAUNCHES.

of the elements," and immediately fell off-beam on to the short steep waves of the Aegean.

We did not need to ask why we had stopped as we all knew that the hammering of the last few hours had stirred up the sediment in the tanks, which now clogged the float boxes and vaporizers. We had a nice mountainous lee shore some ten miles away populated by certain peoples with whom we were at war. For our accommodation they had placed mines a little distance out from the shore, and to warn mariners who would approach the beach they had several nasty guns in commanding places.

I only mention our situation to make it clear that we were anxious to fix up the ship and get back to port and get our mail.

A couple of hours of groaning, squeaking, and the crashing of our last china dishes, brought the chief on deck with the report that she ought to run now, but of course he had not built her and could not tell accurately what would go wrong next, etc., etc.

Owing to the failure of the lighting system we had been unable to use our wireless or searchlight for signalling, but just as we were starting one of our "chummy ships" closed in on us with: "Can we render you any assistance?"

We arrived in our base that afternoon and it was well that our friend had been sent back to stand by to give assistance if necessary, for she had found her port engine trying to free itself from its base and with some degree of success, so they stopped their errant engine and plugged along on none.

That is why, when anyone asks us what we think of standardized ships we reply: "Do you know the coefficient of friction between the seat of your pants and a rolling deck off any enemy and lee shore with no engines?" "Do you know that three M.L.'s blew up within one month with the crews, owing to the leaky gas tanks on which rivet heads were soldered as it was cheaper than drilling and using real whole rivets?"

AUDIBLE CODE CALLING IN SHIPBUILDING PLANTS

Shipbuilding is one of the oldest human arts, and it is probably for this reason that improvements in it have been sometimes difficult to introduce. Certain traditions have been established, certain difficulties and inefficiencies in the handling of men and materials have been found unavoidable at a given stage of the art, and when this or that new improvement has made these limitations unnecessary, routine and traditions have often been found to be so firmly entrenched, that it sometimes takes almost a generation of engineers to introduce the innovation.

The stress of the Great War has shaken the shipbuilding industry probably more than it has many others, and improvements have been introduced in it which otherwise would have been postponed for another half a century. But the war has likewise stirred up more progressive industries to radical changes, so that in some respects the shipbuilding industry is again near the tail-end of the procession.

An illustration in point is the use or rather the non-use, of acoustic signals for calling important men in a shipyard, according to a prearranged code. This great convenience has not been possible until a few years ago, so that the industries had to be satisfied with the usual private telephone exchange. If the person called happened to be at his desk, well and good; if not, and no one knew where he went, the calling person muttered a short expressive word to relieve his feelings, and patiently waited for better luck the next time. Of course, business suffered, but everyone's conscience was clear. There was no way for promptly reaching a person within a large shipyard, not even by means of an intelligent, willing and Marathon-like office boy, if there ever was such a being. This status of inefficient communication has been of such long standing as to be considered by many almost a fundamental law of nature, second only to Newton's laws.

Then a solution came in the form of what is known as the audible code-calling system, whereby each important employee may be instantly located anywhere within the yards or shops and called to the nearest telephone. The new progressive industries and those in highly competitive fields have been quick to see the tremendous advantages of the new system of intercommunication, its convenience, saving in overhead charges, better esprit de corps, and the stimulation of production. But the shipbuilding industry seems to be still playing the part of Rip Van Winkle, for while there are hundreds of large industrial institutions of all kinds in this country in which such a code calling system is in successful use day after day, we know of no installation of this kind in any important shipbuilding plant.

The installation of a code calling system has been considered by the management of some large shipbuilding organizations on more than one occasion, but each time the old inertia has been able to advance a seemingly plausible argument against an investment of a few thousand dollars, to save annually hundreds of hours of time for many high-priced men.

A code calling system is but a further scientific development of the old-fashioned electric bell in a hotel, which you rang twice for hot water and three times for ice water, only instead of one bell we now have a number of suitable electric horns, single-stroke bells, whistles and other acoustic devices mounted throughout the plant in such locations that at least one of them can be heard distinctly, no matter where the person called may be.

With many requests during the day it would be inefficient to ask the telephone operator to push an electric button a certain number of times for each person called. To obviate this difficulty, a simple electrical commutator has been developed, called the klaxocator, which performs this operation automatically. Let us suppose, for example, that the manager wants to speak to Mr. Jones, the engine specialist, on some very important matter. His secretary tries to get Mr. Jones in his office, and the reply comes that Mr. Jones is out in the yard and that no one knows where he is. The telephone operator is then instructed to sound Mr. Jones's code number throughout, consults a list before her and finds it to be, say, 3-4. She sets the klaxocator on this number and pulls a handle. This is all that she has to do and can return thereupon to her regular duties. As soon as the handle has been pulled, all the horns, bells, whistles, etc., in the plant begin sounding three strokes and after a short interval four strokes. This code is automatically repeated three times and then stops by itself. If Mr. Jones is anywhere within the premises, he will hear the call the first or second time and will report to the operator over the nearest telephone. She immediately connects him with the manager's office, and the important conference takes place without further delay.

The convenience of such a method of instant communication between any two important persons within the plant, should be perfectly evident to anyone familiar with the elements of industrial management and efficiency. No plant can be operated in such a way that every head of department or his assistant has a definite place where he can always be promptly found. The usefulness of many of them is in direct proportion to the amount of time that they spend away from their desks and in actual touch with their work of supervision and direction. With the code calling system they may be safely urged to spend practically all of their time in this way, knowing that they would be promptly located whenever needed.

Actual experience in steel plants, in bridge shops, in bolt-and-nut factories, and in similar places, shows conclusively that a comparatively small signal can be distinctly heard in the most noisy location, provided that there is sufficient contrast between the character of the prevalent noise and the sound emitted by the acoustic devices employed, and provided that these are properly located.

The annual turnover of a shipbuilding plant is so large and the need for greater efficiency and economy is becoming so much more pressing every year that a small investment in a code-calling system should not be delayed any longer. Even if it should not be used much in the beginning, due to old habits and inertia, one person after another will use it regularly after that.

Sailing Vessel Converted to a Motor Ship

CONSIDERABLE success has been attained in the conversion of sailing vessels to a motor drive, and the increase in earning capacity is so marked that many owners of sailing ships are pressing on with the utmost energy their conversion to a motor drive.

Amongst the recent successful installations of this kind is the conversion of the ship "Hibernia." The "Hibernia" is an iron ship of considerable age, but was found on inspection and close survey to be in excellent condition. Following on this inspection the conversion was decided on and put in hand.

The following are the particulars of the ship as she now is:

Length, B.P., 139.2 ft.
Breadth, Mld., 21.25 ft.
Depth, Mld., 11.45 ft.

She is rigged as a three-masted fore-and-aft schooner with pole-masts carrying lower sails only. The crew's quarters are forward and the captain, mate and engineers' aft under the raised quarter-deck. Forward of the raised quarter-deck the deck is flush with two specially large cargo hatches to facilitate loading and discharging cargo. Immediately forward of the forward hatch a motor winch is fitted, driven by a 5 b.h.p. Petter Paraffin engine. A notable feature of the useful winch is that it is entirely self-contained, both the cooling water and the fuel oil being held in the bed-plate of the winch. The winch is efficiently protected by a portable steel cover. The fore peak is fitted for carrying water ballast.

THE MOTOR SHIP "HIBERNIA."

The propelling machinery, which is placed aft, consists of one 152 b.h.p. Vickers-Petter semi-Diesel direct-reversing engine driving a single screw. This engine, which is the latest development of the semi-Diesel type, has four cylinders 12 in. dia. x 14 in. stroke, develops its horse power at 300 r.p.m. and starts and reverses by compressed air.

The main fuel oil tanks of 1,500 gallons capacity are placed each side of the engine room. The oil is pumped from these tanks to a daily service gravity tank of 50 gallons capacity and from there to the engine fuel pumps.

The auxiliary machinery consists of a 10 h.p. Vickers-Petter semi-Diesel engine directly coupled to an air compressor and general service pump. On the 5th September, "Hibernia" loaded her first cargo of coal, consisting of 360 tons, on a mean draft of 11 ft. 0 in. On the same afternoon the official trial trip took place on the measured mile off the Tyne. Mr. Arthur Tate, of Messrs. Arthur Tate and Co., Ltd., the owners of the ship, and Mr. J. C. Gunn, of Messrs. Scott, Gunn & J. C. Gunn, Ltd., the N. E. Coast representatives of Messrs. Petters, Limited, were present during the trial trip, which lasted four hours.

With all sails tightly furled, sea slight and beam wind, the engines running at the normal r.p.m. 300 revs., a mean speed on the measured mile, with and against the tide, of 8¼ knots was obtained.

The control of the engine was exhaustively tested both in the passage down the Tyne and also before and after the full speed trial. With the Vickers-Petter rapid starting liquid fuel burner, no pre-heating of the burners was required and the engines were ready to start within a very few moments of the lamps being lit. During the whole of the manoeuvring, stopping, starting and reversing of the engine, the friction clutch was never used to disconnect the propeller from the engine. Each order from the telegraph was carried out instantaneously. In actual practice it was found that the starting of the engine ahead or astern was carried out and the engine actually in motion as soon as the engineer moved the starting lever. Another point well worth of notice is that the clumsy and dangerous method of barring round the flywheel to get the correct starting position is entirely done away with. The engine starts at once with the cranks in any position of the cycle.

The fuel oil used during the trial trip was Scotch shale oil, having a specific gravity of 0.860, calorific value 19,000 B.Th.U., with a flash point of 200 deg. F.

After the trial all the working parts were carefully felt and no signs of heating-up were discernible. The Mitchell thrust block, which is fitted as a standard, was absolutely cold. It is to be noticed that by fitting this thrust block and other improvements in the engine the overall length of the engine is kept as short as possible, so that the length of the engine room from the after-peak bulkhead to the engine room bulkhead is in this ship only 23 ft. 0 in. All excess lubricating oil is carefully drained into a sump of the drip-tray, which runs the full length of the engine-bed plate. From this sump the oil is pumped to an oil-filter, so that all filtered oil may be reserved for further use.

The above details and care with regard to light and air, efficient lighting in the right places, the rigid engine seatings, are essential factors in a successful installation. Since the trial, "Hibernia" has made several successful voyages to Northern French ports from the Tyne, without any trouble whatever. The captain and engineers cannot speak too highly of the Vickers-Petter engine and its steady running.

The following letter has been received from the owners regarding the actual performance of the engine:

Newcastle-on-Tyne,
24th October, 1919.

Arthur Tate & Co., Ltd.,
Exporters of Coal, Coke & Salt.

Dear Sirs,—

Referring to the 152 b.h.p. internal combustion engine supplied by Messrs. Vickers-Petters and installed into our iron vessel "Hibernia," 360 tons cargo, we have much pleasure in advising you that up to the present, namely, after the fourth voyage to France with coal cargoes, the engine has proved to be of first-class workmanship and has run smoothly the whole time.

We are delighted with it and consider that it surpasses any engine we have yet installed in our ships, numbering a dozen. The good results of this engine prove that in Britain we are on a par with, and even can keep ahead of, our competitors in other countries in building this class of engine.

The "Hibernia" made 9½ knots light ship coming from the Humber to the Tyne, and regularly does over eight knots loaded, between here and France. Her average passage with cargo from Tyne or Blyth to Calais has been about 38 hours, and the captain boasts that he has beaten half of the steam-driven coasting vessels in the trade.

We trust that the other engines we have ordered from you, namely, the 220's and 152's, will prove as satisfactory, when we shall have nothing to complain of.

The fuel consumption is lower than that of any of the other makes of engine.

Yours faithfully,
ARTHUR TATE & COMPANY,
Limited.
ARTHUR TATE, Director.

Lloyd's Register Annual Summary of Shipbuilding in 1919

THE Annual Summary of Mercantile Shipbuilding of the World for the year 1919 has just been issued by Lloyd's Register of Shipping. This summary does not include warships. It takes into account only merchant vessels of 100 tons gross and upwards, that were launched in 1919, whether they were completed during the year or are still under construction. Vessels having internal combustion engines and sailing vesesls fitted with auxiliary power are included with steamers. Figures regarding the output during the war period are only shown for allied and neutral countries. Complete totals for Germany not being available for the year 1919, no figures are shown for that country.

United Kingdom

Particulars of Total Output

During the year 1919 there have been launched in the United Kingdom 612 merchant vessels of 1,620,442 tons (viz., 541 steamers of 1,584,920 tons and 71 barges of 35,522 tons).

These vessels have been built of steel, with the exception of one wooden steamer and 53 vessels of reinforced concrete, of which 41 were barges without propelling machinery. Not a single sailing vessel has been launched during the year.

The figures are still 311,711 tons below record figures of 1913, and represent an output 11.2 per cent. lower than the average of the three pre-war years 1911-13; they are, however, higher than the totals for the four years 1915-18, the present total being 272,322 tons and 457,546 tons larger than those for 1918 and 1917 respectively.

It should be noted, however, that the tonnage shown as launched during the war period does not include vessels building to the order of the Government for other than mercantile purposes.

Nationality of Vessels Launched

Nearly the whole of the tonnage launched during the year will be for registration in the United Kingdom, only 29 steel steamers of 97,459 tons, or 6 per cent. of the total tonnage, being for owners residing abroad. This percentage, although higher than during the two previous years, is considerably less than the pre-war figures, which, for the five years, 1909-1913, reached an average of 22 1-3 per cent.

Of the tonnage launched in 1919, French owners acquired 27,861 tons, Norwegian owners 20,054 tons, and Greek owners 18,750 tons.

Size and Type of Vessels

The returns for 1919 show that 127 vessels of between 5,000 and 6,000 tons each, and 62 vessels of 6,000 tons and upwards, were launched; the following were of over 10,000 tons each: "Arundel Castle," 22,150 tons; "Cameronia," 16,000 tons; "Oropesa," 14,000 tons; "San Fernando," 13,056 tons.

Of the steamers building on the Isherwood system of longitudinal framing, 14 were launched, with a gross tonnage of 80,193 tons. Including 12 of these vessels with a tonnage of 68,112 tons, there were launched during 1919 22 steamers of 126,388 tons for the carriage of oil in bulk. The returns also include 53 vessels of 32,467 tons built of reinforced concrete; 102 trawlers, and a large number of vessels designed for Channel, coasting and other special services.

The average tonnage of steamers launched in the United Kingdom during 1919 is 2,930 tons; but, if steamers of less than 500 tons be excluded, the average reaches 4,006 tons, compared to 4,593 in 1918, 4,933 in 1917, 4,080 in 1916, 3,791 in 1915, and 4,460 in 1914.

Vessels Fitted With Turbines or With Internal Combustion Engines

The launches for the year include 17 steamers, with a total tonnage of 148,188 tons, which will be fitted with steam turbines, and five vessels of 32,936 tons which will have Diesel engines.

The four largest vessels mentioned above are all to be fitted with geared turbines. The largest Diesel-engined vessel launched during the year is of 6,980 tons.

Output of Leading Ports

The Glasgow district occupies first place among the shipbuilding centres of the country, showing an output of 337,030 tons. Then follow Sunderland (274,283 tons); Newcastle (239,836 tons); Belfast (213,720 tons); Greenock (188,717 tons); Middlesbrough (119,943 tons), and West Hartlepool (82,238 tons). The largest increase, as compared with 1918, has taken place on the Clyde, the figures for which are 176,987 tons higher than the previous year. The increase for Belfast is 65,461 tons, while in the Newcastle and Hartlepool districts an actual decrease of 26,758 tons and 18,180 tons respectively is recorded.

Progress of Shipbuilding During the Year

As regards the movement of the Shipbuilding industry during the course of 1919, Lloyd's Register quarterly returns show that at the opening of the year, 1,979,952 tons were actually under construction in the United Kingdom. A steady increase has taken place since then. The March returns showed an increase of about 275,000 tons, the June returns 269,000 tons, and the September returns 293,000 tons. The amount of tonnage building at the end of December, 1919, has reached the enormous figure of 2,994,249 tons, that is a further increase of 177,000 tons, so that the total tonnage now under construction is 1,014,000 tons higher than the work in hand 12 months ago.

It may be of interest to compare the December figures with those for June, 1914, namely 1,722,124 tons; and with the "record" pre-war figures of March, 1913, namely 2,063,694 tons, which figure is 930,555 tons less than the work in hand at the end of 1919.

Although the vessels of over 10,000 tons each launched during 1919 only amount to four, it may be stated, as shown in the last quarterly shipbuilding returns that there are now under construction no less than 55 vessels each one exceeding 10,000 tons, 22 of which are of 15,000 tons and above.

Other Countries

Particulars of Total Output

Outside the United Kingdom there have been launched during the year 1871, merchant vessels of 5,524,107 tons (1,554 steamers and motor vessels of 5,203,712 tons, and 317 sailing vessels and barges of 320,395 tons). The figures show an increase of 1,424,783 tons as compared with those for 1918, and are 4,123,378 tons higher than those for 1913, the pre-war record year, equal to an increase of 294 per cent.

The enormous increase in the output of vessels abroad is well illustrated. In 1901 the tonnage launched reached, for the first time, over one million tons, namely, 1,092,800 tons. After considerable fluctuations, in 1913 it reached the pre-war record figure of 1,400,729 tons. After dropping to 550,000 tons in 1915 a remarkable increase, due to war conditions, has taken place. During 1917, 1,775,000 tons were launched, in 1918, 4,100,000 tons, and during 1919 over 5,520,000 tons.

Size and Type of Vessels

The returns for the year include 267 vessels of between 4,000 and 6,000 tons each; 263 of between 6,000 and 8,000 tons; 17 of between 8,000 and 10,000 tons, and five of other 10,000 tons each, three of the latter being steamers of about 15,000 tons each launched in the United States.

The figures for the year include 350 vessels of a total tonnage of 1,939,210 tons to be fitted with turbines, 92 per cent. of which tonnage will have geared turbines. The output for the year also comprises 170 steamers of 1,060,741 tons built on the Isherwood system of longitudinal framing. Including 49 of these vessels of 326,344 tons, there were launched during the year 60 vessels of 369,804 tons for the carriage of oil in bulk. Practically the whole of the tankers and vessels built on the Isherwood system were launched in the United States.

During 1919 there were launched 150 vessels of 123,000 tons to be fitted with internal combustion engines. Only three of these vessels are of over 5,000 tons each, one built in Sweden of 5,525 tons, one built in the United States of 6,090 tons, and one, the largest launched during the year, namely, the "Afrika," of 9,050 tons, building in Denmark. Half of the total number of these vessels are sailing vessels fitted with auxiliary power.

The tonnage of wood vessels included in this year's total is 721,046 tons, which is over 13 per cent. of the total tonnage

launched abroad during 1919. As compared with the 1918 figures, however, there is a decrease of about 425,000 tons. These figures include a large proportion of barges and other craft which cannot be described as real sailing vessels.

During 1919 there were launched 10 steamers of 20,455 tons built of reinforced concrete, two of which, building in the United States, are of about 5,000 tons each.

The countries where the largest output has taken place during the year under review are the United States, Japan and Canada. The totals for these countries amount to 4,958,532 tons, and account for nearly 90 per cent. of the total output abroad.

United States

The output for the year 1919, namely, 4,075,385 tons, is 1,042,000 tons higher than during 1918. The whole of the increase is due to the larger amount of steel steam tonnage launched during the year, which reached about 1,431,000 tons more than during 1918. The wood tonnage, on the other hand, has decreased by nearly 415,000 tons, and is under 13 per cent. of the total output of the United States as compared with over 31 per cent. for 1918.

A remarkable increase has taken place in the tonnage launched on the Atlantic coast, which has reached 1,973,755 tons, or 1,020,000 tons more than the output of last year. The tonnage launched on the Great Lakes is 495,559 tons, about 64,000 tons more than in 1918, and all of which consists of steel steamers intended for seagoing purposes.

The total output of the United States is 57 per cent. of the world's combined output for 1919, and nearly 74 per cent. of the total launched abroad.

The total figures for the United States comprise over 1,900,000 tons of vessels to be fitted with steam turbines, and about 43,000 tons of vessels to be fitted with internal combustion engines, 12 of which are of between 2,000 and 3,000 tons and one of 6,099 tons. Sixty steamers for the carriage of oil in bulk were launched with a tonnage of about 370,000 tons; 49 of these vessels of 326,000 tons were built on the Isherwood system of longitudinal framing, and in addition 115 other vessels of about 714,000 tons were also built on this system.

The total figures comprise 137 steamers, each of between 5,000 and 6,000 tons; 251 of between 6,000 and 10,000 tons, and five vessels of over 10,000 tons each. These vessels—the largest launched abroad during the year—are: Three turbine steamers of about 15,000 tons each launched by the New York Shipbuilding Corporation at Camden, N.J., and two turbine steamers of 10,798 tons each, by the Bethlehem Shipbuilding Corporation at Quincy, Mass.

The number of wood vessels of over 2,000 tons each launched during the year amounted to 168, of which 103 are steamers and the others sailing barges. It may be stated that a number of the latter were intended to be fitted with engines, but have been completed as barges. The largest wood steamers launched were two, both of 3,545 tons, built at Orange, Tex., and the largest sailing barges, four, of about 3,300 tons each, launched in the State of Washington.

The returns of the year include five steamers of 18,046 tons built of reinforced concrete, two of them being of about 5,000 tons each.

Japan

The output for this country—611,883 tons—is by far the highest on record. It is 121,959 tons more than in 1918, and 261,742 tons more than in 1917.

The striking advance of the shipbuilding industry in this country is well shown by the fact that the tonnage launched during 1919 nearly equals the whole output of Japan during the 22 years, 1892-1913.

The 1919 totals only refer to steel steamers; they comprise 48 vessels of between 5,000 and 6,000 tons each, and 22 of between 6,000 and 8,230 tons each. These figures include 14 steamers of over 5,000 tons each launched for the United States Shipping Board. The largest vessel is the Bangkok, of 8,230 tons, built at Uraga for French owners.

The tonnage launched in this country represents over 42 per cent. of the output abroad, outside the United States.

British Dominions

The tonnage launched in Canada—271,264 tons—is about 13,000 tons more than in 1918. In includes 28 steel steamers of 60,233 tons launched on the Great Lakes. On the coast and on the St. Lawrence were launched 12 steel steamers of between 5,000 and 6,000 tons, and 80 wood steamers, 51 of which are of between 1,000 and 1,200 tons, and six of between 2,000 and 2,700 tons.

The tonnage launched in the other British Dominions has reached 87,464 tons, by far the largest total on record. Half of this tonnage represents the output of the Hong Kong district, where eight vessels of between 5,000 and 5,806 tons each were launched.

The total tonnage launched in all the British Dominions during 1919, namely, 358,728 tons, is 78,824 tons more than in 1918, and nearly equals the combined output for the 10 years 1908-17.

Holland

The total tonnage launched during 1919—137,086 tons—is 63,000 tons higher than the 1918 figures, but is still about 43,000 tons less than the record figures reached in 1916. As usual, the figures for this country do not include vessels exclusively intended for river navigation.

Only three vessels of more than 5,000 tons each have been launched, viz.: two of between 7,000 and 7,500 tons building at Rotterdam, and one of 9,700 tons building at Amsterdam.

Scandinavian Countries

The total tonnage launched in Denmark, Norway and Sweden amounts to 146,315 tons, which is 32,859 tons higher than the output for 1918. The increase is fairly divided among the three countries. The total figures include three vessels of over 4,000 tons each launched in Sweden, and one in Denmark of 9,050 tons, viz.: the "Afrika," which is the largest vessel fitted with Diesel engines launched in the world during 1919.

Italy

The total figures for this country—82,713 tons—include for the first time the output of Trieste, amounting to 23,513 tons. The totals comprise nine steamers of between 5,000 and 6,000 tons and three of between 6,000 and 8,500 tons, the largest being the "Monte Grappa," launched at Trieste.

Spain

The totals shown under "Other Countries" include the output of Spain, which, during 1919 has reached 52,609 tons, an increase of over 35,000 tons as compared with 1918. The largest vessel launched in this country was the "Arno Mendi," of about 5,700 tons, building at Bilboa.

Tonnage Building Abroad During the Year

The work in hand at the beginning of 1919 amounted to 4,942,000 tons. The figures for the end of March had increased to 5,541,000 tons, thus reaching the highest total recorded in Lloyd's Register Returns. A continuous decrease has taken place since then, and at the end of 1919 the tonnage in hand was 4,867,000 tons, namely 674,000 tons less than at the end of March.

The pre-war record was reached at the end of June, 1913, when 1,443,000 tons were under construction abroad. The present figures are therefore 3,424,000 tons higher, or an increase of 237 per cent., although 12 per cent. lower than the total building at the end of March 1919.

These results are entirely due, however, to the decrease which has taken place in the tonnage under construction in the United States since the end of March, 1919, which amounts to 1,218,000 tons during the nine months. Taking into account only the tonnage building in other countries abroad, Lloyd's Register Quarterly Returns show that a steady increase has occurred throughout the year, and the tonnage building at the end of 1919 is 544,000 tons more than the work in hand at the end of 1918.

The countries having the largest amount of tonnage under construction at the end of 1919 are: United States of America, 2,966,000 tons; Holland, 328,000 tons; Italy, 314,000 tons, and Japan, 309,00 tons.

Summary of World's Output

The total output during 1919 has been 7,144,549 tons, which is an increase of 1,697,000 tons as compared with 1918, and 3,811,000 tons more than the output for 1913, which was the pre-war record year.

In regard to the enormous increase in the tonnage launched during 1919 as compared with recent years, it is of interest to note that the previous highest totals during the last 20 years were reached in 1901, 1906, and 1913, while the

lowest figures were recorded in 1904, 1909 and 1915.

Vessels Classed by Lloyd's Register

Of the merchant vessels launched during 1919, 1,220 of 4,428,540 tons (483 vessels of 1,407,390 tons in the United Kingdom and 737 of 3,021,150 tons abroad) are intended for classification in Lloyd's Register Book. These figures include nearly 87 per cent. of the United Kingdom's output, and if only the tonnage of the steel steamers launched in the world is taken into account, 65 per cent of such tonnage has been built under the society's inspection. The total figures are the highest ever reached in any one year during the history of the society; they exceed by 927,000 tons the totals for 1918 and by 2,358,000 tons the pre-war record total attained in 1913.

It may be noted that during the last 15 years no less than 26,000,000 tons of new vessels have been launched which were built under the supervision of Lloyd's Register.

The Submersible Pump Described

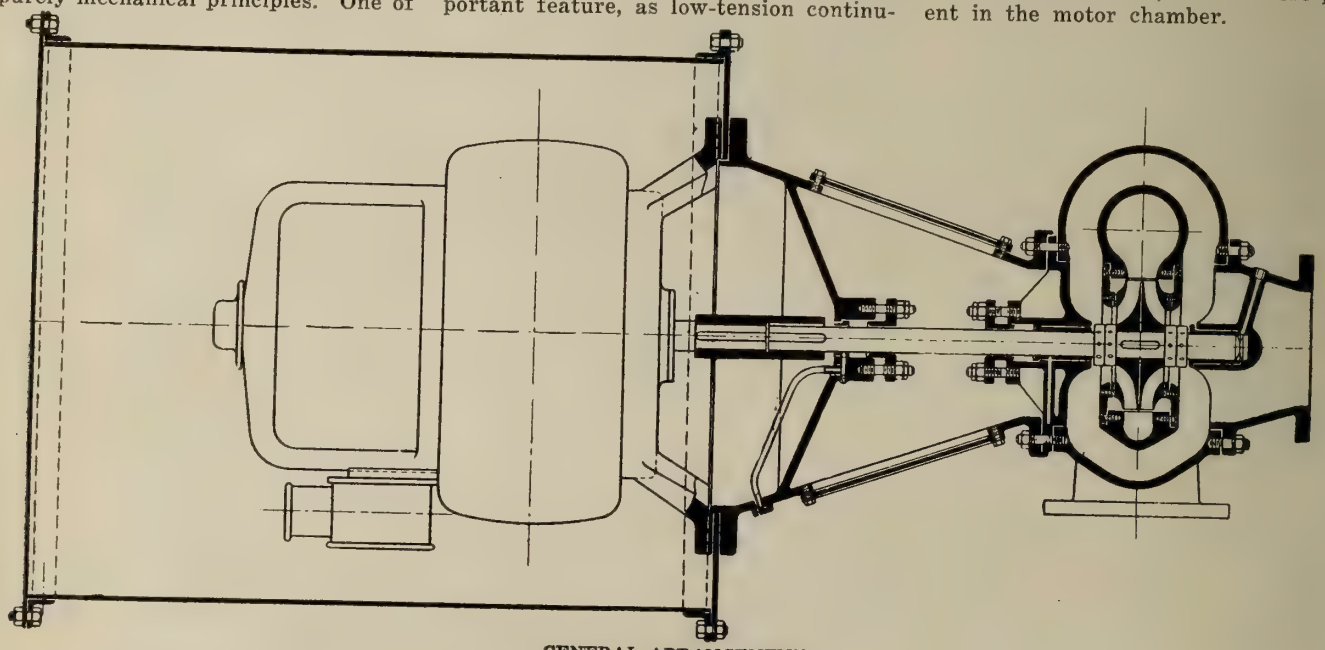
Courtesy of the "Engineer"

THE submersible pump has come to maturity on account of the abnormal conditions created by the recent war, for the production of an electrically driven pump capable of satisfactory operation in a totally submerged condition. The circumstances calling for such a pump and its great utility were so fully dealt with on that occasion that it is not necessary to enlarge on them again; but it may be as well, in view of what follows, to recall that the solution of the problem was found on electrical lines, and to point out that, although, as we indicated at the time, it was so obvious that it was difficult to understand why it had not been arrived at before, there is another answer to the same problem which can be worked out on purely mechanical principles. One of the striking features of the machine under review, a product of Merryweather and Sons, of Greenwich, is its evolution long before salvage afloat had attained its recent importance. Some years ago Merryweather's were commissioned by an Indian rajah to provide an electrically driven pump for raising water from a well in which the water level fluctuated over wide limits, and decided on the simple expedient of enclosing the motor in a water-tight box to prevent its being put out of action in the event of the water rising above the pump. The machine supplied for the purpose was the forerunner of one which we recently saw at work at Greenwich before it was despatched to be installed on board one of the White Star liners.

The arrangement of the set under consideration is shown by the annexed illustration, and is quite simple. Its merit lies in the fact that the makers have found a means of completely excluding water from a chamber in which an electric motor is enclosed, with the result that it is possible to utilize a motor, which may be of any class suitable to the electricity supply on the ship to which it belongs. This is a most important feature, as low-tension continuous current is practically universal for marine service, and it has heretofore been considered impossible to run a motor with a commutator continuously below water level.

The drawing shows how the motor is enclosed in a water-tight cylindrical casing of boiler plate, and is directly coupled to the centrifugal pump. The two parts of the machine are connected together by a truncated conical casing, which is also made water-tight. The pump shaft passes through a stuffing-box as it leaves the pump, and again as it enters the pump casing. Both these stuffing-boxes are provided with Stauffer lubricators, so that they can be well packed with grease. It will be noticed that the stuffing-box on the pump side is in direct communication with the suction inlet, and thus there is a tendency towards the extraction of water from the conical intercepting chamber whilst the pump is running. When the pump is standing the only passage for water into the pump chamber is through the two stuffing-boxes in succession, and the leakage through the first stuffing must fill the intercepting chamber before there is any likelihood of it trying to get through the second box. As a matter of fact, long experience on the part of the makers shows that these pump chambers can be, to all intents and purposes, called water-tight.

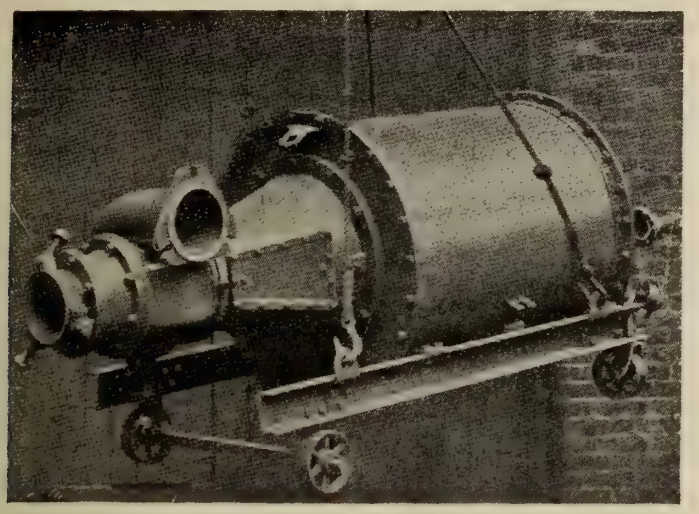
Having established the fact that it is possible to make a box containing the motor water-tight, there are two important matters to take into consideration. One is the rise in temperature of the motor and the other is the possibility of an explosion of oily vapor in the enclosed space. The rise in temperature of the motor, we are informed, does not exceed 70 deg. Fah., while close observation on our part failed to discover the least sign of sparking at the commutator, which might lead to the firing of an explosive mixture, if such were present in the motor chamber.



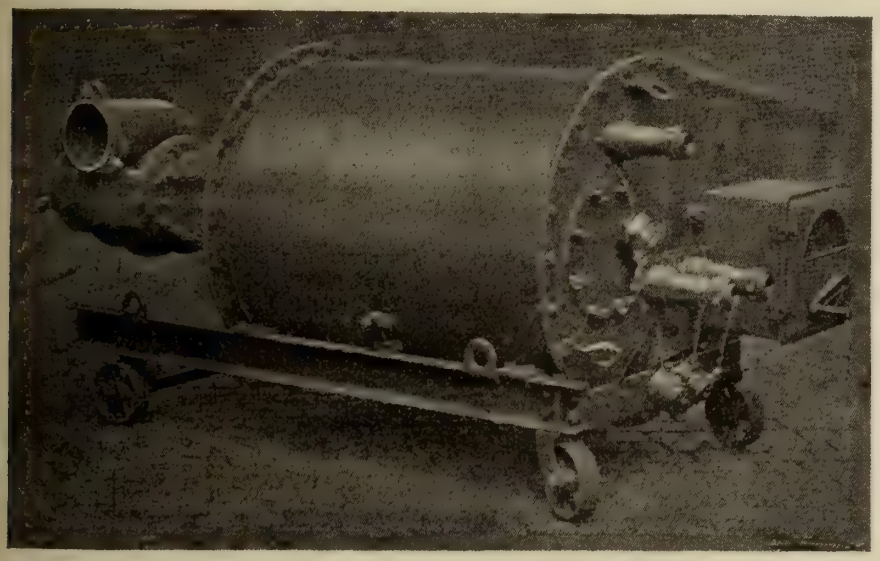
GENERAL ARRANGEMENT

The principal features in the design of the pump itself may be gathered from the line drawing, which shows how a double-inlet impeller is used in order to avoid end thrust on the shaft; while the motor is, of course, designed to suit the individual conditions. Those passing through the shops on the occasion of our visit were supplied by Electro-motors, of Manchester, and arranged for running on 10-volt circuits.

In the engraving it will be noticed that the pumping unit is mounted on a four-wheeled carriage, to which it is attached by means of only two slip bolts. The pump can thus be wheeled about conveniently, and quickly picked up in slings for lowering into the working position. The carriage is equipped with a weather-proof starter for the motor and two water-tight plug connectors for the electrical connections to the supply, and to a third plug connector to the motor casing. The connector alongside the starter is for the main supply, while the other two are used to connect the starter and motor together with lengths of flexible cable according to the distance between the pump and carriage.



The pump which we saw at work has a suction diameter of 8 in., and is capable of delivering, 100 gallons per minute against a head of 35 ft. The motor is of 22 brake horse-power, and the overall efficiency is said to be 75 per cent. The machine weighs nearly 2 tons, but the buoyancy of the motor chamber is so great that it very nearly floats in fresh water.



A New Device for Shipway

THE following description of a patented docking device comes to us from Thomas Reid & Sons, Paisley, Scotland. It is claimed, and the claim seems reasonable, that the capacity of a slip can be increased three to four times by the use of this arrangement.

The purpose of the arrangement is to increase the docking accommodation of a slipway by transporting vessels hauled up on a slipway into one or more berths on either side of the slipway. A vessel with bottom damage, or likely to occupy the slipway for a lengthy period, can be hauled into a side berth, leaving the main carriage free for vessels requiring only a short period on the slipway. It has been found from practice that this arrangement makes it possible to dock four times the number of vessels that could be docked on an ordinary slipway without side berths. It can be adapted to any existing slipway carriage, and does not increase the height of the blocks by more than 1 inch or reduce the docking draft.

The following is a description of the arrangement:

Crossbeams of double steel channels are fitted on top of the main carriage.

Rails are riveted to the lower flanges and the crossbeams are wedged up on the lower side to bring both rails level.

The transporters are built of double steel channels with a continuous plate riveted to the top flanges of the channels.

Cast-iron double rollers are fitted with the rollers outside and to suit the pitch of the rails on the crossbeams.

The side berths have concrete or brick altars, one opposite each crossbeam when the main slip carriage is in its highest position. Each altar carries a pair of steel rails, which are in line and level with the rails on the crossbeams. The altars extend from the ends of the crossbeams to the opposite extremity of the side berths and at right angles to the main slipway rails.

A carriage is provided for connecting several of the centre transporters. The carriage is fitted with rollers and runs on the side berth rails. The side haulage ropes are connected to this carriage and led to the down haul-drum of the main slipway winch round guide-pulleys, or to two capstans placed at the side of the side-berths, in line with the pull.

Method of Docking and Side-Berthing a Vessel

The carriage is prepared by fitting keel and bilge-blocks on top of the transporters. These blocks are 1 inch higher than the standing-blocks on the main slipway carriage. The main slipway carriage is then lowered and the vessel docked in the usual manner. The blocks on the transporters being 1 inch higher than the standing-blocks on the main carriage, the vessel will be resting on the transporters and clear on the blocks on the main carriage, so that when the carriage has been hauled up, and the rails in the crossbeams coincide with the rails on the side berth, the vessel can be hauled across at once, leaving the main carriage with the standing-blocks ready for docking another vessel.

To haul the vessel into the side berth the connecting carriage is brought up to the ends of the transporters and the connecting-pins dropped into place. If the main haulage winch is to be used for side-hauling the vessel, the wire-rope is roved round the guide-pulleys and fastened to the connecting carriage. If separate capstans are provided for that purpose, the rope will be already connected, so that the vessel can be hauled into the side berths without delay.

To undock a vessel from a side berth the process is simply reversed. The wire-rope is led from the opposite side across the main carriage and the vessel with the transporters is hauled into place on top of the main carriage, and the connecting carriage disconnected when in position.

The average time occupied in docking a vessel and hauling it into a side berth is about one hour.

Eastern and Western Canada Marine Activities

January Correspondence

R. Duguid has resigned from the position of manager of the Tidewater Shipbuilders, Limited. Pending the appointment of a new manager, the duties of the office will be taken over by the president, A. A. Wright.

* * *

The first instalment of machinery and power equipment that will be used in connection with the new plant of the St. John Dry Dock and Shipbuilding Company, at Courtenay Bay, has been delivered to the site. This shipment consists of four carloads and will form part of the twenty carloads that will be required to fit out the plant. The machinery, when unloaded, will be stored in an adjoining warehouse until the buildings are ready to receive it.

* * *

George Hadrill, who, for the past 34 years, has been the active secretary of the Montreal Board of Trade, and who has been associated with that body for a total of 43 years, has resigned from the position he has so efficiently filled for so many years. His services will be retained in the capacity of "secretary emeritus," while the active duties of the office will be taken over by J. Stanley Cook, who has acted as assistant secretary for the past 22 years. Mr. Cook has been carrying the bulk of the burden for several years back, and has the full confidence and respect of every member of the Board.

* * *

At the annual meeting of the Montreal Board of Trade recently a resolution was passed endorsing the action of the council in their efforts to have the Government to remove the present Business Profits War Tax. It is the opinion of the members of the Board that the present tax is detrimental to the development of the country, and that if such revenue is still necessary the same should be derived by some more general method of taxation. Another feature of the business of the meeting was the unanimous endorsation of any action that would promote closer trade relations with the British West Indies. The officers for the ensuing year will be George Sumner, president; Hon. Lorne C. Webster, vice-president; Arthur Lyman, treasurer; and Stanley Cook, secretary.

* * *

At a meeting of the Canadian West Indian League, held early in the month at the Windsor Hotel, Montreal, at which Frank H. Keefer, Parliamentary Under-Secretary of State for External Affairs, was the guest of honor, a resolution was passed by those present, in which the Government would be urged to appoint a commission that would confer with the various Governments of the West Indian colonies with a view of helpful co-operation for the extension of trade between the two countries. Many of the members felt that the time was very opportune for stimulating of production of Canadian goods for export to these colonies. Canada is at present a heavy buyer of West Indian products, but a very large percentage of the tota comes to this country through United States channels, and it is the hope of the League that a considerable amount of this trade can be carried on direct.

* * *

Announcement has been made by officials of the Canada Steamship Lines, general agents for the Fracanda Line, that a new service will be inaugurated on February 24, between Canada and the port of Bordeaux. Winter sailings will take place from St. John, N.B., but vessels will come up the river to Montreal during the summer season. The success that has been attained by the previously established trade service between Canada and Havre has been an influencing factor in this latest step of the company. In speaking of the new service, Mr. Doherty, general traffic manager of the Fracanda Line, said: "Importers and exporters should benefit greatly by this service, as the port of Bordeaux serves a section of France not conveniently reached through Havre or other northern ports. The establishment of our Havre service was the result of our faith in the future trade relations between Canada and France, which we realized could be developed only through direct steamship connections. Our faith in the service of this venture has been fully justified and the support extended us has encouraged us to extend our field by a direct service to Bordeaux. Early indications point to liberal patronage of the new line from the start and the likelihood of our being justified in the very near future in increasing the sailings to two steamers monthly."

* * *

The development of the Canadian import and export business is exemplified in the greatly increased demand upon the harbor authorities here for wharf accommodation. At present the facilities are insufficient to meet the demands for space, but with the completion of three new sheds now in course of erection, it is expected that ample berth and wharf accommodation will be available early in the navigation period. For the beginning of the season, some of the new services using the port will have to co-ordinate with those who possess the main sheds.

* * *

In this connection it might be stated that a recent Order-in-Council has sanctioned an advance in wharfage charges for the port of Montreal. The new rates are virtually in force, but the advance will not be actually felt until the opening of navigation. The charges will, as usual, be on a graded scale, but will approximate an increase of about 20 per cent. over those in force last year. In view of the general conditions of higher labor and operating expenses, it is felt that the action of the Government will meet the approval of manufacturers and shipping interests.

* * *

Joint action has been taken by the Government of Canada and the United States to refer the deepening of the St. Lawrence for navigation, and the utilization of the river for power development purposes. In a note addressed to C. A. Magrath, chairman of the Canadian section of the commission, the Hon. N. W. Rowell stated that the scheme would be made the basis of an investigation, so that the commission may submit a report to the two countries, together with such conclusions and recommendations as may be considered pertinent. The appointment of engineers will be the first step, and they will be empowered to obain all the necessary data and information, which will be placed in the hands of the commission before the close of the year, and the commision in turn is requested to forward to each Government the final report, with recommendations, not later than three months thereafter.

* * *

Research work that has already been done in respect to this undertaking has been the basis of considerable discussion amongst engineering and scientific men, and the contentions are so varied that a thorough investigation is imperative before definite action could be contemplated. A stubborn fight is expected from those Eastern States that border the Atlantic. According to the estimates of Obadiah Gardner, the chairman of the American section of the Commission, the cost of deepening the St. Lawrence for lake to ocean service would involve an expenditure of over $50,000,000, and the development of the estimated energy of 2,000,000 horsepower going to waste would require an additional $200,000,000. It is expected that the advantages derived by this last mentioned undertaking will aid in removing the opposition that prevails in some quarters. Both Governments are anxious to have a report at the earliest possible moment.

* * *

The executive of the Canadian Association of Shipbuilders and Engineers have started on a campaign to organize the industry throughout the country, and the secretary, Capt. W. J. Gerrard, has been delegated to interview the different engineering firms with the purpose of securing their support. It is hoped

that with closer co-operation between the various firms and the employees that industrial conditions will be more stabilized and resultant benefits increased. In speaking on the question of closer relations, Mr. Gerrard said:

"Our organization is anxious to do all it can have shipbuilding, and engineering generally, made vital and important national industries. Success in this direction can only be achieved, where employer and employee recognize conditions and are respectively ready to carry out obligations based upon a knowledge of conditions and entered into with a sincere desire to do everything possible to maintain industrial peace."

In commenting on the action of the Canadian Association, Thomas Biggert, secretary of the Clyde Shipbuilders' Association, said:

"I am pleased to note that an engineers' and shipbuilders' association has been formed in Canada. In these days of great development in shipbuilding affairs, combined action and unity of purpose on the part of manufacturers is essential. Such an organization is no menace to workmen or their interests. Many years ago Mr. G. N. Barnes, now a prominent member of the Government of this country, told me that the formation of the Engineering Employers' Federation had been one of the best developments that had ever taken place in the interests of the Amalgamated Society of Engineers and of engineering work."

BRITISH COLUMBIA

The Federal Government has ordered the expropriation of some seventeen acres of land at Skinner's Cove, Esquimalt, for the establishment of the big Dominion dry dock, and it is expected that contracts for the building of the structure will be let within a few weeks. The Federal Cabinet passed in December an Order-in-Council which formally recorded the selection of Skinner's Cove as the dry dock site. According to the wording of the Order-in-Council, this site was found to be by far the most suitable, although as a naval base it would be at a serious disadvantage on account of the lack of protection afforded against a possible sea attack by way of the Straits of Juan de Fuca. It is the intention to develop the dry dock for commercial purposes, however, the naval feature being secondary in importance.

* * *

A report that French interests wish to purchase the yards of the Foundation Company in Victoria and build there forty wooden steamers of about 3,500 tons, has caused a considerable stir in Coast shipping circles. The French interests are represented by Captain F. Argon, who is now negotiating for the yards through Hon. John Hart, Provincial Minister of Finance. The Foundation Company has abandoned all hope of securing more contracts itself, and part of the two four-way yards have already been dismantled. The last of the twenty wooden steamers built by the company for the French Government left here for France late in January.

During its operation in Victoria the Foundation Company spent $11,000,000, of which $5,264,300 was paid out for labor alone. Sixty-four thousand, five hundred tons of wooden shipping was turned out by the company during the year 1919.

* * *

The Chile Maru and Peru Maru are to be placed on the Northern Pacific run by the Osaka Shoshen Kaisha this summer. They will probably be dispatched to this side some time in June. Japanese shipyards will be busy with naval building this year. If the appropriations now before the Diet for naval construction are adopted, the capacity of the shipyards for merchantmen will be reduced from one-half to one-third. But as an offsetting factor against this is the fact that the United States Shipping Board vessels being built in Japan will be completed before long. Perhaps the one factor will counterbalance the other. During the war Japan's shipbuilding capacity was devoted entirely to the construction of freighters, and building of passenger ships, fishing vessels, dredgers and other ships for special purposes was neglected. This year it is expected that orders for this type of craft will be placed with the shipbuilders. In addition, the Nippon Yusen Kaisha is to build 500,000 tons of cargo and passenger ships during the next five years, and other shipping companies also contemplate building new ships.

* * *

The Harbor Marine Company, which has contracts for the building of two steel freighters and which will have both vessels at the launching stage within two months, is still making an effort to secure additional orders; so far, without success. The company holds that when contracts were awarded for the two ships, assurance was given that there would be more orders later.

* * *

The Victoria Shipowners (B.C.), Ltd., which endeavored to work out a co-partnership scheme with its employees for the sharing of building costs in connection with the building of four wooden schooners by its associate company, the Cholberg Ship Company, has been informed that the Federal Government will not countenance any plan that will force employees to buy shares in the company. The Government insists that the matter be left entirely optional with the workers. The Government has agreed to loan up to 70 per cent. on the cost of building, the private interests furnishing the remainder. Following receipt of the Government's ruling against co-partnership, the directors abandoned the plan and will endeavor to secure the capital from sources other than the employees.

The capitalization of the B. C. Marine Ways, Vancouver, has been increased to $1,000,000 and extensive alterations will probably be made to the plant, which is already rated among the best equipped ship repair establishments on the coast.

The Canadian Government Merchant Marine steamship, Canadian Inventor, 8,100 tons, was launched at the Coughlan yard in Vancouver January 23. The firm has established a reputation for launching on time, and in spite of a heavy snowfall, got the boat off the ways on schedule time. The Canadian Inventor is the third ship of the Government contract to be launched by the False Creek yard.

* * *

The use of directional wireless on the coast of British Columbia would prevent many wrecks, loss of time and consequent expenditure of fuel, to say nothing of the mental anxiety to masters of ships approaching and navigating these waters, according to Captain Henry Pybus, who has written to the Board of Trade here. He urges that the system has passed the experimental stage, and that the United States could probably be induced to install directional wireless along the Alaska coast to work in conjunction with the Canadian stations.

* * *

The prize schooner Leonor, captured off the Mexican coast early in the war by the Canadian cruiser Rainbow, and tied up ever since in Victoria harbor, has been ordered returned to the former owners by the Admiralty Court in London, but the Government will appeal from the decision. The claim of the Government was that the Leonor was enemy-owned inasmuch as her transfe from Fred Jebsen, of international notoriety, to the firm of Rademacher, Muller & Company, Guaymas, was done for the purpose of avoiding the consequences of the vessel being enemy owned.

* * *

An agreement has been signed between the British pilots and the Dominion Government by which the former will work for the latter at a fixed salary of $325 a month, less 5 per cent. for superannuation fund.

* * *

Newman Erb, New York railroad man and financier, has commenced a legal fight here to determine the ownership of the Prince Rupert Drydock and Construction. Erb, who represents a syndicate of Eastern capitalists, claims a controlling interest, while virtually the same claim is put forward by John L. Mullin, of Prince Rupert.

ST. JOHN, N.B.

The C.P.O.S. liner Grampian sailed from St. John, N.B., on January 28, for Liverpool, with eight hundred passengers and a full general cargo.

William Marshall, of St. John, N.B., was a member of the crew of the steamer Canadian Spinner, while she was ice-bound off the Quebec coast. He had a good story on the privations of

the crew during the period of isolation. Marshall saw service in the Canadian infantry in France.

Thirty-five per cent. of the members of the Longshoremen's Union in St. John, N.B., are veterans of the Great War. The total membership of the union is placed at 1,500.

Greece is getting Canadian grain in large quantities. The steamer Willpolo sailing from St. John, N.B., on January 24, carried a full cargo of wheat for the Greek Government.

The car ferry between Prince Edward Island and the mainland of New Brunswick has experienced, during the present season, the worst ice conditions since going on the route. The severe weather has caused ice to form in the harbors which has proved a great hindrance to navigation.

The steamer Orari sailed on January 26 from St. John, N.B., for New Zealand and Australia via the Panama Canal with twelve passengers and a general cargo.

A St. John, N.B., shipping man has estimated that the value of liquor which will pass through that port during the present winter port season would pay at least one-quarter of the Canadian national debt.

The Furness liner Glespian sailed from St. John, N.B., on January 27 for Antwerp with a cargo of grain and manufactured goods.

The steamer Clairton, which arrived in St. John, N.B., on January, was the first ship to reach this port direct from Germany since the war started. The ship carried 2,000 tons of potash for the United States and Cuba. She sailed under the British flag and an English captain was in command.

The grain shipments from St. John, N.B., to Italy have been very heavy this season. On January 27 the steamers Grof Kuen Henderway took 212,191 bushels, and the Fedora, 170,824 bushels, while on February 1 the Protea took 189,900 bushels of wheat. All this was consigned to the Italian Government.

The cold weather during the early part of February was the cause of the longshoremen in St. John quitting work on many of the ships in port. Operations were continued uninterrupted on the mail steamers.

A BRILLIANT WAR RECORD

H.M. torpedo boat destroyer Forester was delivered to the Navy by Messrs. J. Samuel White & Co., Ltd., her builders, on January 11, 1912. Designed as an "I" Class destroyer, she was laid down on September 7, 1910, and launched on April 12, 1911. Her principal dimensions are—length, 246 ft.; breadth, 25 ft. 7 in.; depth, 15 ft. 6 in.; displacement, 760 tons; S.H.P., 13,500; and her main armament consists of two 4 in. guns and two 12 pounders, with two 21 in. torpedo tubes.

On November 13, 1918, she was given the honor of leading the Allied fleets through the Dardanelles and to Constantinople; an incident which Mr. Charles De Lacy, the well-known painter, has so faithfully transferred to canvas.

It was fitting that the Forester, with such a brilliant war record, should have been chosen for the afore-mentioned honor.

She took part in the battle cruiser action in Heligoland Bight, on August 28, 1914; helped to bombard Zeebrugge on November 23, 1914; was in the battle cruiser action on the Dogger Bank on January 24, 1915; and played an important part in General Allenby's great attack on the Turkish forces in Palestine, his triumph and subsequent advance.

The Forester (Commander T. Richard Down, R.N., D.S.O.), and the Druid alone represented the Navy in the action of September 19 and 20, 1918; they heavily bombarded the Turkish coastal positions at point blank range and subsequently inflicted great losses on the enemy's retreating forces.

From the outbreak of war until December, 1916, the Forester was with the 1st Destroyer Flotilla attached to the Harwich force. After refitting and recommissioning with a new crew, in January, 1917, she joined the 1st Flotilla at Portsmouth for convoy duties, but in August, 1917, was transferred to the 4th Flotilla at Devonport for similar work. In April, 1918, she went to the 5th Flotilla in the Mediterranean, and there she remained until she came home in July, 1919.

During the period of her convoy duties at Portsmouth and Plymouth, she rescued the crews of the following torpedoed steamers—Camberwell (which was sunk), Berrima, and City of Lincoln. In addition she took the Berrima safely into Weymouth and the City of Lincoln into Falmouth. She also rescued the crew of H.M.T.B.D. Contest, which was torpedoed and sunk, and in the case of the French sailing vessel Eugene Louise, abandoned after being attacked by an enemy submarine, the Forester salved the ship and took her into Falmouth.

During her period of service in the Mediterranean the Forester took a prominent part, from April to September, 1918, in contributing to the success of the Otranto Anti-submarine Barrage, and whilst so employed stood by and assisted in the rescue of the crew of H.M.T.B.D. Phoenix, torpedoed and sunk in the Adriatic, May, 1918. In August, 1918, she captured and salved an Austrian aeroplane, in the Adriatic also.

Quoting her commanding officer, the Forester was "the most economical of 51 boats in the Mediterranean Flotilla and never had a breakdown or gave any trouble. A perfect sea boat and handles beautifully. She was in every way a most splendid boat, and I shall always look back on the period in which I commanded her with pride and pleasure."

During the war she steamed 160,472 miles—in all probability a record unbeaten by any ship, large or small.

PRICE OF SECOND-HAND VESSELS

The value of second-hand vessels can be gathered from the following account of an auction sale in London recently. The report is taken from an English contemporary:

Messrs. C. W. Kellock & Co. offered for sale on Wednesday, Jan. 21, at the Merchants' Hall of the Baltic Mercantile and Shipping Exchange, by order of the Government, the steamers Canning, Menelaus and Nigeria, and, by order of the Marshal of the Prize Court, the steel hulk Lucida. There was a large attendance. The sale was conducted by Mr. H. G. Kellock, who, at the outset (this being the first time this year that he has conducted an auction) extended to the company his best wishes for a "Happy, prosperous and peaceful year."

The first vessel offered was the steel two-deck steamer Canning, 5,375 tons gross and 3,465 net, built in 1896, and stated to have carried about 7,575 tons d.w., and to have steamed about 13 knots. Her dimensions are 425.2 ft. by 52.1 ft. by 28.5 ft., and she was offered as she lies at Portsmouth. Bidding started at £20,000, rose by sums of £5,000 and £10,000 (twice) to £75,000, and eventually to £100,000, for which she was bought on behalf of a firm of Greek owners.

The steel two-deck steamer Menelaus, 4,497 tons gross and 2,846 net, was built in 1895, and is stated to have carried about 6,000 tons d.w. on about 23 ft. 8½ in. draught, and to have steamed about 12 knots on about 35 to 40 tons. She is 392.4 ft. long, 47.1 ft. broad, and 26 ft. deep, and was offered as she lies in the Thames. The first bid was £70,000, and after £80,000 had been reached in bids of £5,000, the price rose to £90,000, for which the vessel was sold to Mr. W. R. Davies, of Liverpool. One of the conditions of sale to which attention was drawn by the auctioneer was that the buyer is to change the name of the vessel within three months.

The steel two-deck steamer Nigeria, 3,775 tons gross and 2,391 net, was built in 1901, and is stated to have carried about 5,105 tons d.w., to have had accommodation for about 87 first-class and 60 second-class passengers, to have steamed 13 knots, and to have been fitted with new auxiliary boiler in 1912. The vessel is 352 ft. long, 44 ft. broad and 23.5 ft. deep. She was offered as she lies in the Tyne on the date of sale. The opening offer was £10,000. Bidding reached £21,000, for which the vessel was bought by Messrs. Claude Langdon, Ltd., London.

The steel hulk Lucida, formerly a steamship of about 2,000 tons capacity but with her engines now removed, was built in 1899 and fitted with boiler winches and steam windlass. She is about 241.7 ft. by 36.2 ft. by 17 ft., and she was offered as she lies at Invergordon. The purchaser was Mr. J. G. Pallister, of Middlesbrough, for £31,000.

The Art of Properly Splicing Wire Rope

The art of properly splicing wire rope is something that is not understood by very many mechanics in spite of the fact that it should be one of the things about which they should know. The result is that in many cases a faulty splice is made, and an accident of some nature or other at a later date. We received a short time ago, from the Canada Wire and Iron Goods Co. of Hamilton, a very interesting catalogue on their line of wire rope and fittings, and in this book was a short article on the proper splicing of wire ropes, which is well worth reproducing.

Before going into the article proper, however, we might add that to any one interested in wire ropes, their uses and applications, a copy of this price list catalogue for 1919 is well worth a place on the desk.

The subjects of wire rope construction, materials used, the proper method of ordering and other valuable information are all given. Certain tables of useful information are also added at the back portion of this interesting book.

To get on to the subject of the splicing of wire rope, however. Following is the method in which they present this material.

Directions for Splicing Wire Rope

Wire rope is susceptible to the most perfect splice; a smoother and better splice can be put in a wire rope than in any other kind of rope, for the simple reason that it is made with a view to this purpose. It has just the desired number of strands, namely, six, and a hemp core, which provides a place for fastening the ends. It is a plain, simple process and but the work of an hour for any one to learn.

To Get the Length of the Rope to be Spliced Endless

In most cases the ropes can be applied endless, and in such cases the ropes can be forwarded spliced ready to go on. We can furnish ropes ready spliced by giving us the exact distance from centre to centre of shaft, and the exact diameters of the wheels on which the rope is to run. This measure can be got best by stretching a wire from shaft to shaft, marking the distance from centre to centre of shaft and carefully measuring the wire.

In cases where the endless rope cannot be put on, the rope has to be put around the sheaves, hove taut by pulley blocks, and the splice made on the spot. See Fig. 1 in diagram of splices.

The Necessary Tools

A hammer and sharp cold chisel for cutting of ends off strands; a steel point or marlin spike for opening strands; two slings of tarred rope with sticks (see Fig. 5) for untwisting rope; a pocket knife for cutting the hemp core; a wooden mallet and block.

First.—Put the rope around the sheaves, and heave it tight with block and fall (see Fig. 1). The blocks should be hitched far enough apart so as to give room between to make a 20-foot splice. A small clamp may be used to prevent the lashing from slipping on the rope where the blocks are hitched (see Fig. 1). Next, see that the ropes overlap about 20 feet; about ten feet each way from the centre, as shown by the arrow lines in Fig. 1. Next mark the centre on both ropes with a piece of chalk or by tying on a small string. Now proceed to put in the splice, with the blocks remaining taut when it is necessary, but the better way is to remove the blocks, throw off the rope from the sheaves, let it hang loose on the shafts, and then proceed with the splices on the ground or floor, or scaffold, as the case may be.

Second.—Unlay the strand of both ends of the rope for a distance of 15 feet each, or to the centre strand of both ends of the rope for a distance of 15 feet each, or to the centre mark. Next cut off the hemp cores close up, as shown in Fig. 2, and bring the bunches of strands together so that the opposite strands will interlock regularly with each other (see Fig. 3).

Third.—Unlay any strand A, and follow up with one strand of the other end, laying it tightly in open groove made by unwinding A; make twist of the strand agree exactly with the twist of the open groove. Proceed with this until all but twenty-four inches of one are laid in Next, cut off A, leaving an end about twenty-four inches long.

Fourth.—Unlay strand 4 of the opposite end and follow with strand D, laying it in open groove as before, and treating this precisely as in the first case (see Fig. 2). Next, pursue the same course with B and 2, stopping six feet short of the first set. Next, with 5 and E, stopping as before, then with C and 3; and lastly with 6 and F. The strands are now all laid in with ends six feet apart, as shown in Fig. 4.

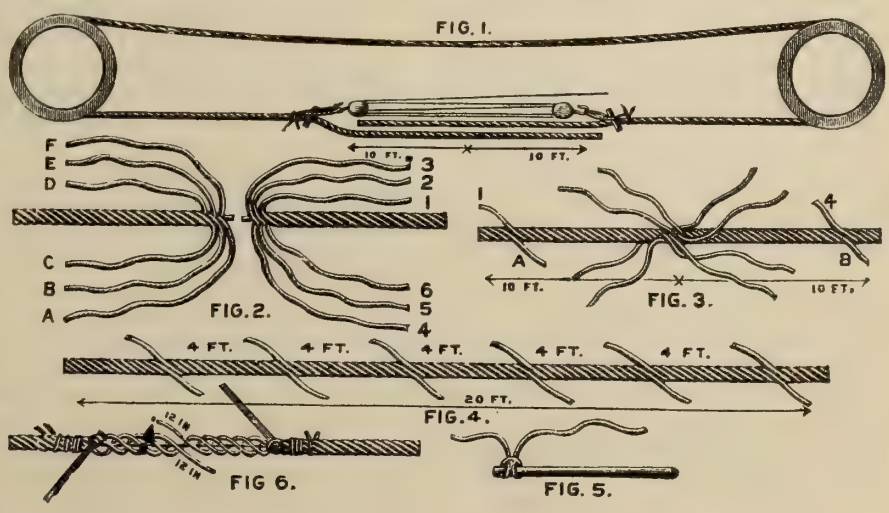
Fifth and Last.—The ends must now be secured without enlarging the diameter of the rope. Take two rope clamps (see Fig. 5), and fasten them to the rope, as shown in Fig. 6; twist them in opposite directions, thus opening the lay of rope.

Next, with a knife cut out the hemp core for the necessary distance. Now straighten the ends and drive the marlinspike under the strands (see Fig. 6), and work end into the space previously occupied by the hemp core; then twist the clamps back, closing up the rope. The ends should be laid in, side by side—that is, they should not be crossed over each other. At the point where tuck is made, hammer with copper mallets to fix the strands firmly in place. Next, shift the clamps and repeat the operation at the other five places, and the splice is made.

The Board of Trade have appointed a committee under the chairmanship of Sir Thomas Bell, K.B.E., to advise what conditions should be complied with in order to prevent danger of fire, including fire resulting from collision, in the case of passenger ships burning oil fuel, and what special precautions, if any, are necessary in the case of oil fuel with a flash point as low as 150 degrees Fah.

The secretary to the committee is Mr. G. C. Ager of the Board of Trade, and any communications with regard to the work of the committee should be addressed to him at the Board of Trade, Great George Street, Westminster, S.W. 1.

A large quantity of the heavy machinery for the operation of the dry dock, now under construction at Courtenay Bay, St. John, N.B., has arrived. Included in the equipment are engines and derricks. Good progress has been made in the work at the new dock, and it is expected that it will be ready for receiving ships inside of two years.



PROGRESS IN NEW EQUIPMENT

There is Here Provided in Compact Form a Monthly Compendium of Shipbuilding and Marine Engineering Auxiliary Product Achievement

A NEW BALANCED VALVE

The following is a description of a new balanced valve, the invention of Mr. Allen Norgrove, Le Pas, Manitoba:

This invention relates to improvements in slide valves for steam engines and has for its object to provide a valve for this purpose so designed that the sliding element of the valve is balanced by the steam pressure in all directions, whereby the tendency of the sliding element to bind against the walls of the valve, due to inequality of pressure on its various sides, is entirely removed.

In carrying out my invention I provide a casing, in which the slide valve is adapted to reciprocate, so constructed that steam passing into the engine cylinder strikes the slide on diametrically opposite sides, passes around a groove in the slide, and enters a chamber leading to the engine cylinder through diametrically opposite ports disposed at right angles to the first ports through which the steam is admitted to the slide. In a similar manner exhaust steam leaving the engine cylinder strikes against the slide on diametrically opposite sides, travels around the groove in the slide and leaves the groove through two diametrically opposite ports at right angles to where the steam leaving the cylinder first strikes the slide. Two such valves are provided on each cylinder of the engine. It will, of course, be understood that the slide in the valve is reciprocated by suitable mechanism connected with the engine, this mechanism being well known in the art and forming no part of the present invention.

By reference to the accompanying drawings the nature of the invention may be more clearly apparent.

Figure 1 is a side view partly in section and partly in elevation of the valve in neutral position.

Fig. 2 is a section looking in the direction of the arrows on line 2—2 of Fig. 1.

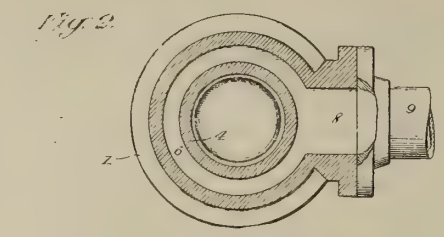
Fig. 3 is a side view partly in elevation and partly in section, but at right angles to Fig. 1 showing the valve in intake position.

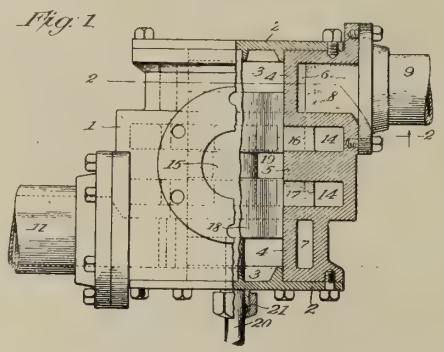
Fig. 4 is a section in the direction of the arrows on line 4—4 of Fig. 3.

Fig. 5 is a full section showing the valve in exhaust position, the section being taken from the same side of the valve as Fig. 1.

Fig. 6 is a section on line 6—6 of Fig. 5.

In the drawings 1 is a valve casing provided at each end with plates 2. The casing is formed with a central valve chamber 3 defined by walls 4, preferably cast integral with the casing. Disposed one above the other and completely separated from each other by a partition 5 are two annular steam chambers 6 and



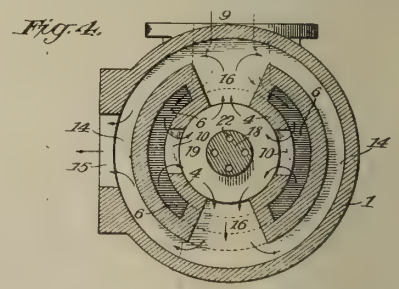


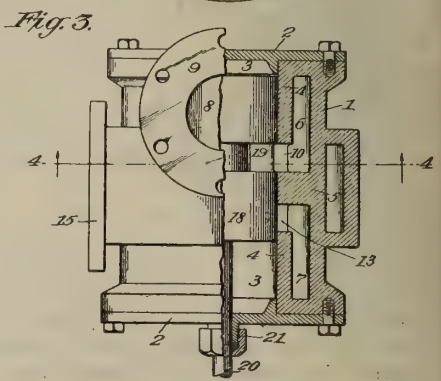
7. The upper steam chamber 6 communicates by means of passage 8 with the steam feed pipe 9. In the same horizontal plane, but directly opposite each other, are two ports 10 passing through the wall 4, permitting the passage of steam from the inlet steam chamber 6 to the valve chamber 3 (see Figs. 3 and 4). In a similar manner the lower steam jacket 7 connects with the exhaust pipe 11 through passage 12, and communicates with the valve chamber 3 by means of diametrically opposed ports 13 lying in the same horizontal plane and preferably directly beneath the ports 10 in the inlet or live steam jacket. The arrangement of ports for the exhaust steam jacket is in all respects similar to that of the inlet steam jacket.

Surrounding the jackets 6 and 7 is an annular chamber 14 communicating with one end of the engine cylinder through passage 15. Passing through the walls of the jacket 6, in the same horizontal plane as inlet ports 10, are diametrically opposite ports 16 connecting the annular chamber 14 with the valve chamber 3. The ports 16 are so placed that their centre line is disposed at right angles to the centre line of the ports 10 (see Fig. 4). Directly beneath the ports 16 is a similar pair of oppositely positioned ports 17 connecting the chamber 14 with the valve chamber 3, these ports being in the same horizontal plane as exhaust ports 13, but having their centre line at right angles to the centre line of the ports 13, the arrangement being exactly similar to the arrangement shown in Fig. 4 for the steam inlet valve. The outer chamber 15 is not divided horizontally, but webs 5 ft. extending from the partition 5 tend to separate the ports 16 and 17, although these could be well dispensed with at the point where they extend across the chamber 14, only the partition 5 being necessary.

Sliding in the valve chamber 3 is a piston 18 provided on its circumference with an annular groove or duct 19. This duct is preferably made slightly narrower than the partition 5 and is adapted, upon reciprocation, to register with ports 10 and 16 and then with ports 13 and 17. The piston is reciprocated by a rod 20 passing through gland 21 on lower plate 2 and suitably connected with the valve operating mechanism on the engine in any manner well known in the art. The piston is preferably constructed with open ends in order that gases may pass freely from one end of the valve chamber to the other to avoid compression of the gases in the valve chamber. In the drawings I have shown holes 22 passing lengthwise through the piston to prevent compression of the gases in the valve chamber.

In operation the live steam from pipe 9 passes through passage 8 and fills the upper live steam chamber 6. When the piston 18 is moved inward to permit groove 19 to register with ports 10 and 16, as in Figs. 3 and 4, the steam passes through ports 10, impinging against opposite sides of the piston with equal pressure. The steam then travels around the groove 19 in both directions and out the diametrically opposite ports 16 exerting an equal pressure on the opposite sides of the piston (see Fig. 4). It will thus be seen that the valve is balanced both by the steam impinging against it and the thrust of the steam leaving the groove. From ports 16 the steam passes into the annular chamber





14 and then into the engine cylinder through passage 15. When the engine cylinder is exhausting the valve piston is moved to the position shown in Fig.

Fig. 6.

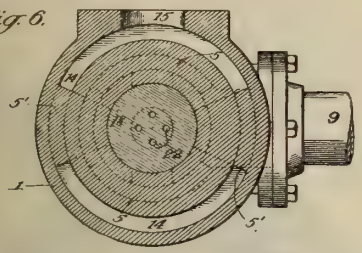
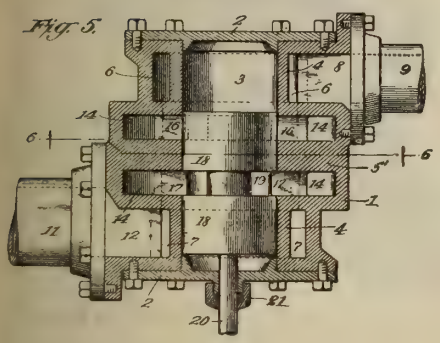


Fig. 5.

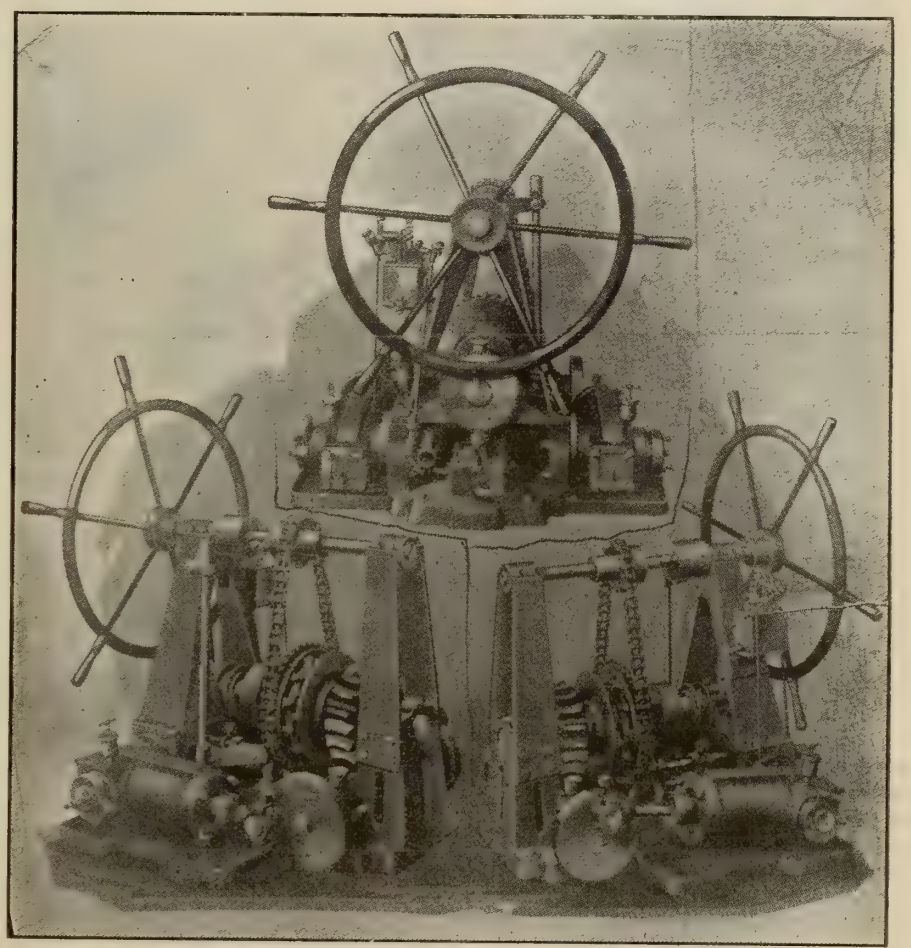


5, when the groove 19 registers with ports 13 and 17. The exhausted steam being pushed from the engine cylinder passes through the passage 16 into chamber 14. From chamber 14 it passes out the diametrically opposite ports 17 into groove 19, the pressure being equal upon each side of the piston 18. The steam then passes around the groove 19 in both directions and at the opposite ports 13 into the lower exhaust jacket 7, and thence through passage 12 into the exhaust pipe 11. It will be seen that while the piston is in intake position ports 13 and 17 are closed by the main body of the piston, and while the piston is in exhaust position the ports 10 and 16 are closed by the body of the piston. It will also be seen that when the ports are closed by the piston, the pressure of the steam in the ports against the piston always balances on diametrically opposite sides.

During one cycle of operation in one valve, a similar valve connected with the opposite end of the engine cylinder is operated in a similar manner, but is reversed to feed steam to the engine cylinder while the first is exhausting, and vice versa.

A NEW STEERING GEAR

There has lately come to our notice along with the great amount of new designing in marine engine practice that Canada has developed during the war a type of steering engine in which the oscillating type of engine has been made use of. J. Bruce Hanly and S. C. Hanly, who received their technical training in the School of Science, Toronto, have for the last 25 years been in touch with the Great Lakes steamboat trade, are the designers. They have been serving the steamboat trade in general repair work to machinery and hulls, and the knowledge gained during this time has been made use of to perfect this machine. While this style of engine has some objections, they have been overcome, and their good points have been made use of for this particular service and has added greatly to the efficiency of this steering gear. Where space is at a premium and strength is necessary, we know of no gear that is its equal. It combines a hand-steering with steam power and is quickly changed from one to the other. The base which occupies a floor space 34 in. fore and aft, and 36 in. athwart ship (they have another design which only occupies a space of 24 in. x 36 in., which will be put in the market in a short time), carries two standards, which support a shaft and chain wheel for rudder chain, also a hand-steering wheel on second shaft directly above the first. In practice, this steering wheel shaft carries also a sprocket, which in turn is connected with the chain sprocket wheel combined on main shaft by Baldwin roller chain. The engine is made to stop, start and reverse by a small movement of the hand wheel. Arrangements are made to change the gear from steam to hand power in a few seconds, first by pulling pin out of arm controlling throttle valve; second, by pushing in sprocket wheel; third, by releasing jaw clutch from chain wheel. This brings into action the Baldwin roller chain and the two sprockets, which are ratioed two to one, give plenty of power when used by hand. There is an automatic closing device, which stops it either hard to port or starboard. An indicator shows position of rudder at all times. Is supplied with automatic oil sight feed pump and other oiler specialties. The steering gear is especially adapted for tugs and steamboats, where the space is limited. This is manufactured by the Midland Engine Works Co., Midland.



THE HANLY STEERING GEAR.

ECONOMY IN BURNING OF FUEL OIL

Norman M. Campbell

If steel shipbuilding is to survive in Canada, close attention must be paid by Canadian shipyards to every method that will tend to reduce manufacturing costs. Plate and angle furnaces are an essential part of the equipment of any steel shipbuilding company, and there is no considerable room for improvement in the design of many of the furnaces in use for these purposes.

Considering the very large increase during the last few years in the use of fuel oil for furnace work in shipbuilding plants, to say nothing of the comparatively high current prices for fuel oil, any method of burning that oil that will tend towards economy should be of interest to the industry.

Furnace engineers generally recognize that the most efficient way of burning oil would be to burn it in a gaseous state, thus securing a complete molecular mix-

ing of the oil and air necessary for combustion, with its attendant great increase in economy. Under such a condition it would be possible to operate with just sufficient air to theoretically complete combustion, or 100 per cent. air. Combustion would also be completed in a fraction of the time needed ordinarily, much higher flame temperature would be secured, and this would cause the stock to be heated much more rapidly.

Still further economies would result from the use of the waste heat of the flue gases to preheat the air for combustion, and to reduce the oil to the desired molecular condition. Intelligent furnace design would further tend to reduce furnace radiation losses.

In the ordinary type of oil burning furnace the oil is sprayed or blown into the combustion chamber by the use of air or steam pressure, but this method is faulty in several respects. It requires a large excess of air to burn the oil without smoking, and all of this excess air must be raised to the maximum furnace temperature and then be exhausted from the furnace. This excess air produces a distinct loss in furnace temperature, cuts down production as the heat goes into the air instead of into the stock, where it is wanted, and naturally increases the oil consumption in the furnace, to say nothing of the increased tendency to scale the stock.

In the case of smaller furnaces, the blast sweeps through the furnace unconsumed and final combustion takes place outside of the furnace chamber. Free oil is destructive of the firebrick lining of the furnace and with such a furnace accurate temperature control is next to impossible.

In the "Oilgas" furnaces recently introduced and manufactured in Canada by the General Combustion Company of Canada, Limited, Montreal, the regenerative principle is used, the hot flue gases being carried back through properly designed passages and around suitably constructed preheaters through which the air supply to the furnaces passes. The waste heat of the flue gases is transferred to the incoming air blast and the temperature of the air raised to about 800 degrees to 900 degrees F. At this temperature the air is conveyed to the vaporizers, into which the fuel oil supply is introduced, the quantity of air being under close control and limited to the chemically exact amount necessary to perfect combustion. The oil is vaporized by the hot air blast and the design is such that an intimate molecular mixture of fuel and air is secured in the form of a gaseous mixture, which is introduced into the furnace through specially designed nozzles.

This process, known as the Sklovsky process, is the result of many years of investigation on the part of Deere and Co., the large agricultural implement manufacturers at Moline, Ill., and is fully covered by patents in Canada.

The use of "Oilgas," combined with limitation of the quantity of air entering the furnace to the chemically required ratio, makes possible very high furnace temperatures, which in turn result in greatly increased production from a given size of furnace or considerable reduction in the size of the combustion chamber for a given output, with consequent cutting down of radiation losses, which are directly proportional to the area of the walls and inversely proportional to the thickness of the walls.

Again, the high temperature secured through the use of Oilgas has a direct effect upon the rate of heat transference. Experiments have shown that to raise a piece of stock to a temperature of 1,500 degrees takes twelve minutes in a furnace of 1,600 degrees temperature; four minutes in a 2,000 degree furnace; two minutes in a 2,500 degree furnace; 1.2 minutes in a 2,700 degree furnace.

The economy of more rapid heating is self-evident, particularly when it is considered that the oil required to obtain high temperatures in furnaces does not increase with the increased temperature, because resulting improved preheating of the air enables the operator to reduce the air supply to the furnace. The operator can secure at will either a neutral or reducing atmosphere in the combustion chamber, according to the percentage of air mixed with the oil, and avoid oxidation of the stock.

In a number of recent installations of Oilgas furnaces, where they were put into direct competition with some of the most widely advertised and best known furnaces of the spray type, the saving of oil was shown to be in excess of 50 per cent., and in every case a considerable increase in output was secured.

The saving contrasted with powdered coal, city gas, natural gas or producer gas is equally remarkable, and warrants careful investigation by anyone interested in lower production costs.

WAHLSTROM TAPPING ATTACHMENT

The Wahlstrom Tool Co., 5520 Second Ave., Brooklyn, New York, have placed on the market their automatic tapping attachment as illustrated.

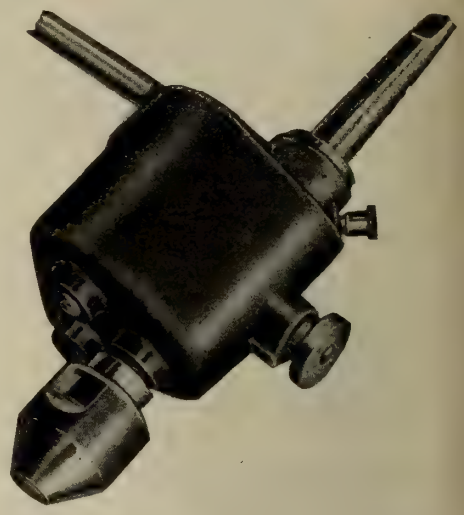
This attachment imitates hand tapping but is at least ten times faster, and handles all sizes of taps up to ½ in. The hand-tapping movement is obtained by means of steel gears so arranged as to provide an oscillating movement, the backward movement clearing the chips, thus saving the taps.

The forward movement being greater than the backward movement advances the tap, while the return movement is continuous and works at an increased speed. With this attachment there is no danger of stripping the thread.

No springs are used, the movement being absolutely mechanical. The taps from the smallest to largest size are driven positively, without any adjustment being necessary.

If tapping cast iron or soft material, you can, by turning a knob on the attachment, make the movement continuous in place of oscillating.

All parts are of steel, hardened and ground throughout. There is nothing to get out of order, and every part is carefully machined to place. This device is handled by the Aikenhead Hardware Ltd., 17, 21 Temperance Street, Toronto, Canada.



GENERAL VIEW OF THE TAPPING ATTACHMENT

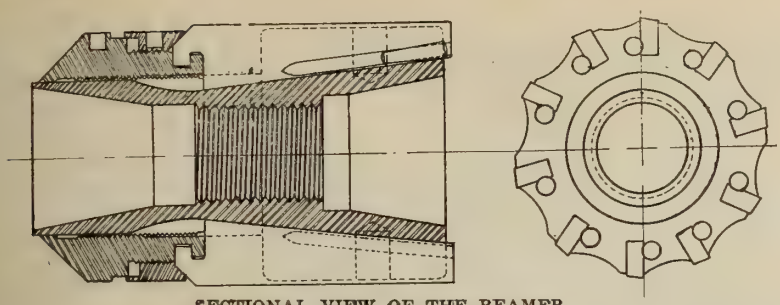
THE DAVIS EXPANSION REAMER

For a long time the old style of solid shell reamers were used, but with the constant improvement of other machine shop equipment, the necessity of a reamer whose blades could be expanded in a practical manner to compensate for wear, was keenly felt. Numerous types of adjustable reamers were placed on the market from time to time, the majority of which were controlled and locked with individual blade screws or pins. But none of these fully met all the requirements of the trade. The great percentage of these went into the discard, but there are still several types of adjustable reamers which have survived.

Some time in the year 1909, Mr. E. E. Davis, general manager of the Davis Boring Tool Company of St. Louis, Missouri, also realized the necessity for a thoroughly practical expansion reamer. With the aid of his thorough knowledge of boring equipment and metal boring requirements, as well as an exceptional mechanical experience, he set to work solving the problem. The result was the Davis expansion reamer, one of the greatest improvements on record in the history of machine tools.

The entire principle and design of this tool were originated by Mr. Davis, and in December, 1912, a patent was taken out as a protection against infringement.

The distinguishing features of the Davis expansion reamer are simplicity and practical construction, with fewer parts than any other tool of similar type. All wearing parts are hardened. All threaded parts are protected from dust, chips or possible injury which



SECTIONAL VIEW OF THE REAMER.

might result from careless usage or accident.

The blades are positively controlled by an accurate micrometer adjusting dial, graduated in quarter thousandths, which acts for both expanding and receding of blades. The blades are slotted and fit over the ring on an adjustable dial which prevents their movement either way without turning the dial. When the reamer is set to size required the blades are individually and doubly locked to reamer body by a locking principle which positively locks the blades without the use of screws, virtually making a solid reamer in its entire principle.

Blade Efficiency

Davis expansion reamers require but three groups of blades to cover range of sizes from 1⅝ inches to 6 inches, inclusive. The large range of sizes covered, together with the greatest possible range of expansion, will show a decided increase in the number of holes reamed per set of blades.

When the blades for the 6-inch reamer are worn under size, they can be used in a number of smaller sizes down to and including 4-1/16 inches. Blades for the 4 inch reamer can be used in smaller sizes down to 2½ inches. Blades in the 2-7/16 inch reamer can be used in smaller sizes down to 1⅝ inches.

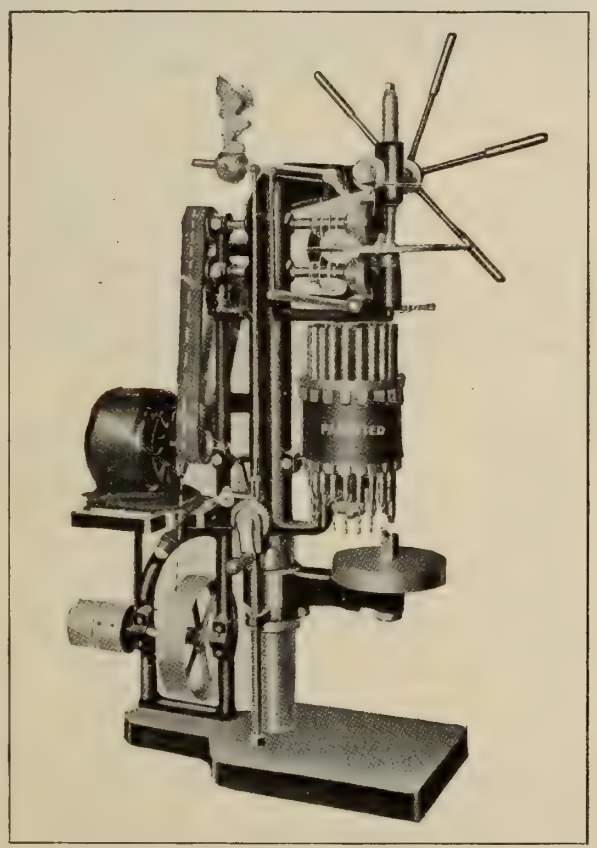
This is reamer blade efficiency at lowest blade expense, and means 100 per cent. to 300 per cent. more holes reamed per set of blades than with any other similar type of reamer.

The Davis Boring Tool Company, Incorporated, are the originators of the forward movement of blades for the purpose of expansion in a tool of this type. This feature always keeps the blades cutting in advance of the tool body, consequently the blades never lose their bottoming feature.

LIMA MULTIPLE-SPINDLE MAGAZINE DRILLING MACHINE

The multiple-spindle drilling machine, shown in the illustration and manufactured by the Lima Drill Press Co., Lima, Ohio, is known as the magazine type, and has features not common to multiple drilling machines. This machine will be found useful in the toolroom and to the shop man who has use for a number of various size drills, reamers and countersinks, eliminating the necessity of hunting and changing tools for each different operation.

The magazine having 16 spindles acts as a drill rack for 16 different sizes of tools. Each of these can be quickly brought into position for immediate action by simply turning the magazine to the point where the drill to be used is in alignment with the driving shaft. When a spindle is in the correct position for drilling, the magazine is locked by



GENERAL VIEW OF THE DRILL.

means of a bar, attached to the machine column which engages one of the slots in the bottom of the magazine.

At the top of the magazine there is provided a convenient combination gauge and index showing at a glance the size of each drill. When a drill is changed, the gauge and index are also changed, which eliminates all delay and guesswork. The drill holders are arranged for straight-shank drills, small split collars being provided for the various sizes. The drills can be removed independently or a drill and spindle together can be lifted out from the top of the magazine. All the drill spindles except the one in position for work are locked in the "up position" and cannot be accidentally forced down. When an operation is completed and the feed wheel is released the tool is returned to the up position by an internal coil spring which acts similarly on all the spindles. The magazine is automatically unlocked when the friction drive is disengaged, and can be easily turned to right or left when shifting another drill into position for work.

A noteworthy feature is the friction drive which is obtained by means of an aluminum disk 10 in. in diameter and ¼ in. thick. The disk is attached to the driving shaft and is driven by means of two leather covered friction wheels, each being 2½ in. in diameter and ½ in. wide. These driving wheels are directly opposite each other, the one above resting against the upper surface of the disk and the one below about ⅛ in. away from it. When the feed wheel is turned, the lower friction wheel is automatically forced against the under side of the disk, thus causing it to revolve.

Speed regulation is automatically obtained for each drill when rotating the magazine into place, as a rack-and-pinion device changes the position of the two friction driving wheels on the disk. When the driving wheels are near the centre of the disk, the disk and spindle will obviously travel at maximum speed, and the drills are so arranged in the magazine that the smallest drill is in alignment for use at that time. The machine is suitable for drilling wood as well as metal, and each spindle works in an adjustable bronze bushing arranged to take up lost motion due to wear. The illustration shows the machine arranged for both motor and countershaft drive.

The two opposed wheels serve a two-fold purpose by doubling the frictional contact and balancing the thrust.

Trade Commissioner.—J. Vernon McKenzie, who has recently left the MacLean Pub. Co. to accept the position of Canadian Trade Commissioner for Scotland, with headquarters at Glasgow, will make a brief tour of the Dominion, between Winnipeg and the Maritime Provinces, during the next six or seven weeks. Any manufacturers or others interested in exporting to Scotland who may wish to get in touch with Mr. McKenzie, or who may wish to have him make inquiries for them in Scotland, may address communications to the editor of this journal, who will see that they are forwarded. Or communications may be addressed direct to the Secretary of the Canadian Manufacturers' Association, Montreal. Mr. McKenzie will make his headquarters there until early in March, and after that communications will be forwarded.

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Progress in Marine Power

SINCE the day when the old paddle and sailing vessel "Savannah" crossed the Atlantic, ships and ships' propulsion have gone through a constant process of evolution. The first great change was the introduction of the screw propeller, to replace the paddle. This in turn brought about modification of the engine, and many and various were the expedients adopted. The trunk engine, the return connecting rod, the geared engine, in which the propeller was geared up instead of down, as regards revolutions, all had their day. The inverted vertical type then made its appearance, and speedily gained favor. In its early days it was a single crank engine, with a huge fly-wheel, and some of these steamers were running from Antwerp to the far East as late as 1906. They belonged to the famous Blue Funnel line of Alfred Holt & Co., Liverpool. Pressures were low, from 15 lbs. to 25 lbs. per square inch. With more knowledge of metallurgy, and better manufacturing facilities, higher pressures came into vogue, and the compound expansion engine appeared. The advantages of this type were so marked that a further development was soon made, and triple expansion was adopted. This seemed to mark the limit, for although quadruple expansion was adopted in some large ships, the triple expansion became the main marine prime mover. However, the marine engineer never feels content with any achievement, and it was not many years before the Hon. Chas. Parsons adapted the steam turbine to marine propulsion, marking the greatest innovation since the days of Fulton. About the same time Dr. Diesel's oil engine was being adapted to marine work. The steam turbine rapidly came into favor for high-powered, fast vessels, but was unsuitable for the ordinary steamer. This was on account of the efficient speed of the turbine being too high for the efficient working of the propeller in the ordinary slow vessel. This seemed to limit the usefulness of the turbine, till the inventor of the turbine tried out a reduction gear between turbine and propeller. It proved successful, and was further developed, double reduction gears being used, till now the largest and fastest vessels in the world use this type of prime movers. The oil engine, backward for a long time as a marine proposition, has been rapidly developed in the last four or five years, till now it is taking its place as a competitor of both turbine and steam reciprocator. Future development will no doubt result in the supremacy of either the geared turbine or the oil engine, with the gradual disappearance of the reciprocating steam engine.

A Boat With a History

THE Powhattan, the big American transport that was towed into Halifax a few days ago after being tossed around off the coast for almost a fortnight, has had a rather interesting history.

She was formerly the Hamburg-American liner Hamburg, and prior to that the private yacht of one William Hohenzollern, the former German Emperor.

It was on the Powhattan that former Emperor William visited England in 1906. At this time he was reputed to have paid the Hamburg-American line $4,256 a day for the use of the liner, which was then known as the Hamburg.

Later the vessel was used to carry Theodore Roosevelt and his party to Europe in March, 1909, when he made his trip to Africa hunting big game. In 1914 the liner was chartered by the American Red Cross to take doctors and nurses to the European war zone, and made a number of trips in this capacity, under the Red Cross.

When the United States entered the war in 1917 the Red Cross vessel was renamed Powhattan and placed in the transport service. The vessel carried thousands of soldiers to Europe and return without incident, beginning her last trip on September 23, 1919.

The Minister of Marine Talks on Shipbuilding

After Receiving a Deputation of Shipbuilders From All Over Canada, the Hon. C. C. Ballantyne Makes an Interesting Statement at the Dominion Marine Association Dinner

EARLY in January a deputation composed of the leading shipbuilders in Canada went to Ottawa to lay before the Government their claims for a measure of protection to carry their industry over the critical period. The companies represented were Canadian Vickers Ltd., Montreal; British-American Shipbuilding Co., Welland; Collingwood Shipbuilding Co., Collingwood; Canadian Allis-Chalmers, Bridgeburg; Davey Shipbuilding Co., Lauzon, Quebec; Halifax Shipyards, Halifax; Midland Shipbuilding Co., Midland; Port Arthur Shipbuilding Co., Port Arthur; Dominion Shipbuilding Co., Toronto; Tide Water Shipyards, Three Rivers, Que.; Three Rivers Shipyards, Ltd.; Nova Scotia Steel & Coal Co., New Glasgow, N.S.; Prince Rupert Dry Dock & Shipbuilding Co., Prince Rupert, B.C.; Wallace Shipyards, Vancouver, B.C.; J. Coughlan & Sons, Vancouver, B.C.; Yarrows, Ltd., Victoria, B.C.

The petition was as follows:

"Prior to the outbreak of war steel vessels were built in Canada in only a few shipyards, which produced intermittently a small tonnage of lake cargo and passenger vessels, scows, dredges, buoy steamers, etc. Subsequent, however, to the outbreak of war, all the existing companies and a number of new ones, have energetically gone in for steel shipbuilding, and many extensive shipyard organizations have been built up. The capital actually invested at present is approximately $47,000,000, exclusive of working capital, and the industry furnishes employment to approximately 23,500 men in the shipyards (not less than 25 per cent. of these men having served overseas) and almost another 23,500 men engaged in the construction of ship plates, shapes, machinery furnishings and equipment. Adopting the usual standard of dependents for each workman, over 200,000 persons are subsisting on this industry at present. An important feature to be noted is that the expenditure for labor and material in ship construction is almost entirely made within the country, whereas the product is chiefly for export, the result being additional wealth for the country.

"Owing to the great demand for tonnage in 1916, the British Government, through the Imperial Munitions Board, induced the existing steel shipbuilding yards in Canada to construct steel ships. These were built, not only in the yards on the lakes but also at Vancouver, Montreal and elsewhere. In the latter yards cargo vessels were constructed as large as 8,800 d.w. tons. When the present Dominion Government came into power in 1917 it very wisely decided that Canada required a merchant marine of her own, and from that date up to now that work has kept the existing steel yards in Canada fully occupied. From the above some idea of the magnitude of the industry can be formed, and the importance to the country of continuing its operation is manifest.

The Minister of Marine has publicly referred from time to time with pride to the results accomplished, and the shipbuilders feel confident that the Government will assist them in maintaining their operations. Following the suspension of hostilities, the Canadian Government shipbuilding programme provided the necessary work to keep the yards occupied to full capacity, and, what was more important, Canada has been able to greatly expand her export business and to supply ships that will be needed to co-operate with the Canadian National Railways, thereby greatly improving the Government's transportation system. It must be gratifying to the Government to know how enthusiastically its shipbuilding programme has been received throughout the country, and that when its fleet of ships is completed it will have placed Canada in the position of trading successfully with other countries.

The Minister of Marine made the statement in Parliament in May, 1919, that the Government was nearing the end of its shipbuilding programme and clearly indicated that if the shipyards in Canada hoped to continue they would have to look for business elsewhere. When introducing the Government's shipbuilding programme in March, 1918, the Minister of Marine made the statement that the Government's policy was to encourage shipbuilding as a permanent industry, which policy was confirmed subsequently by the encouragement given to the erection of a large plate mill at Sydney, N.S.

"The workmen employed in our Canadian shipyards have demonstrated their efficiency and ability to build ships in a sound and workmanlike manner, and equal in all respects to those constructed in any other country, and in fairness to the workmen and their dependents, and having regard to the large capital invested, we submit that the present time is most opportune for co-operation between the Government and the shipyards to the end that this great industry be firmly established. A reasonable bounty would enable Canadian shipbuilders to compete in the markets of the world for business, and permit them to operate to

their fullest capacity, resulting in the ultimate reduction of costs and the placing of the industry on a permanent basis. In addition to the world-wide financial difficulties, the shipbuilders are also faced with the abnormal conditions of exchange, which at present militate so greatly in favor of Great Britain. Our shipbuilding industry commenced a few years ago, with wide difference in wages and efficiency as compared with the British shipbuilder, skilled in his trade from the days of his apprenticeship. The experience received on the vessels we have built has gradually increased the efficiency of Canadian workmen, and if this industry can go on continuously for a term of years, the excess labor cost in Canada will disappear, and Canada will have a national asset represented not so much by $50,000,000 of operating shipyards, as by an army of skilled shipbuilders. Skilled labor is a nation's asset.

"The applicants therefore ask as an essential to the life of their industry, that the Dominion Government grant for a term of ten years a bonus of $10 per load displacement ton, and $10 per indicated horsepower on steel ships built in Canada and completed after April, 1920. Without the assistance asked for, the existing plants cannot be continuously employed, and the breaking up of the organizations will necessarily follow, thereby throwing large numbers of men out of employment, and undoing much of the good which the Government has achieved by the encouragement given to the shipbuilding industry, and in the employment of returned soldiers and men previously at work on munitions. We are convinced of the great merit of our request and respectfully ask your earnest and favorable consideration and prompt action in the matter.

"Signed on behalf of the companies above named by J. F. M. Stewart, Toronto, and W. L. Murray, secretary."

The request was taken into consideration by the Government, and towards the end of January an announcement was made by the Hon. C. C. Ballantyne at the annual dinner of the Dominion Marine Association. After reviewing the general situation as regards shipbuilding he stated that the Government were considering the building of 15,000-ton passenger steamers with a speed of 18 knots. These vessels would be of the mixed passenger and cargo type, and would be built in Canada. He spoke of the ships of the Government programme, stating that there were still 37 vessels to be delivered of the programme of 60. The full report of the speech follows:

"It may interest you to know that we have sixty steel ships under construction at the present time. When those ships will be finished, not later I hope than this time next year, we will have a net tonnage of 360,000 tons. Twenty-three of these vessels are in commission at the present time. Their tonnage ranges from the lake size vessels of 3,750 tons to as much as 10,500 tons, ships that are being built by Mr. Norcross at the Halifax shipyards, so you will see, sir, that we have a very good nucleus now, and by this time next year, with our sixty ships, we hope to greatly expand Canada's export business.

"The country at the present time, due to the war and the other expenditures that were necessary, is of course rather handicapped. With a young and growing country like this, and more particularly if Canada will expand her export trade, everything will come out all right, and I hope that the manufacturers of Canada will take full advantage of the Government mercantile marine and go actively after foreign business.

"I might say that while those ships are built by the Dominion Government, and owned by the Government, they are not operated or managed by the Canadian Government. The Canadian Government Merchant Marine, which is a subsidiary company to the Canadian National Railways, while it is owned by the Government, it is the company that operates and manages the Canadian Government mercantile marine. Mr. D. B. Hanna and his board of directors have an absolutely free hand in the management of the Government ships. As Minister of Marine I never assume to dictate to them in any way at all, neither does any other member of the Government. The responsibility for the success of the Government's mercantile marine rests entirely on the shoulders of Mr. D. B. Hanna and his board of directors.

Equal to the Best

"What routes they shoull be used on, what freight they will carry, what the rates of freight will be, is not a matter for the Dominion Government to deal with.

"We have yards from Halifax to Prince Rupert. Canada's shipbuilding programme is young. A great deal of credit is due to the Canadian shipbuilders for having risen to the occasion when the Government asked them to undertake steel shipbuilding for the first time, to think that they have done as well as they have.

"I am not saying anything beyond absolute facts when I say that the steel ships that have been built in our yards throughout Canada are equal in design, workmanship and efficiency to similar ships built in England, Ireland or Scotland.

"Now, it is astonishing to find that the capital invested at the present time in the shipyards amounts to the very large sum of 47 millions. The number of men employed in shipyards only is 23,500.

"No less than twenty-five per cent. of those men have served overseas. Then, in addition to that there are 25,000 men engaged in the construction of ship plates, ship machinery, designing, and so forth. Adopting the usual standard, there are at least two hundred thousand men who are subsisting at this time on these industries.

"Another important feature is that the material that enter into the construction of these ships is very largely produced in our own country and by Canadian workmen.

"Another very gratifying fact to the Government is that, notwithstanding when the war was on, Canada was able to produce steel ships at as low cost as any other nation was doing, and in a great many cases even less.

"Our ships contracted for during the war have all cost considerably less than $200 per ton deadweight, and as soon as the armistice was signed the Government was able to close for contracts at $25 per ton less than what they did during the war, so I think this speaks very well indeed for the efficiency and the energy of our Canadian shipyards and the men who are engaged in them.

Realize Good Profits

"Then, in addition to that, and what is a great deal more important to the Government, one of Mr. Hanna's officials was good enough to give me figures as to the ships that were in operation, showing that the net profits of these ships was a very handsome one indeed, and that reflects a great deal of credit on the management of the Canadian Government Merchant Marine.

"Now, our Canadian shipbuilders having demonstrated that they can build freight ships economically and efficiently. I am proud to be able to tell you that Dr. Reid, as Minister of Railways, on the representations that have been made to him by Mr. Hanna for passenger ships of a one-class type—I refer to a passenger ship of 15,000 gross tons, and with a speed of 18 knots, and carrying both passengers and freight—that the Government has under consideration at the present time the building of such a type of steel vessel.

"I am happy to tell you that the Government has no intention whatever of ordering outside of Canada the one-class passenger and freight ship of the dimensions that I have stated. It is the intention of the Government to have the passenger ships built in this country by our Canadian workmen and to use Canadian material.

As For Protection

"The shipbuilders waited upon the Government this week at Ottawa, asking in their modest way for a certain amount of protection of the shipbuilding industry. The matter will receive the consideration that it deserves at the hands of the Government. I do not know what action the Government may take, but I want to assure the shipbuilders here tonight that your representations will receive the most careful consideration of the Government, and I hope before the House meets that you will know whether or not you are going to get aid from the Government.

"Your request appears reasonable in view of the fact that there is no protection of any kind whatsoever on ships coming into Canada. Other industries in this country have received a certain amount of protection for a great many years, and in that way the country has been able to build up very large industries from one end of Canada to the other. If the Government is able to see its way clear to assist you in any way I look forward to a very great expansion of the shipbuilding industry in Canada.

"I believe that a large number of the

biggest shipbuilders in England will likely come to Canada to erect plants. I had interviews with many of them when I was in England in 1918.

"Dr. Reid, Minister of Railways, who wanted an all-Canadian shipping property, said in part:

"I can remember well the vessels that passed through the canals. At that time were vessels probably of about ten or twelve hundred tons; those vessels were running between Port Arthur and Montreal, and between Chicago and Montreal. We used to think that they were great vessels. However, a short time afterwards public opinion and the marine men themselves, decided that vessels of that type were useless, that they would have to build larger vessels, and on the advice of the marine men submitting the class of vessel that was required—the large vessels that were required to travel between Port Arthur and Montreal, and do work on the Great Lakes—plans were made by the Government to provide a water-way between Port Arthur and Montreal, and it was decided to enlarge the Welland Canal. Is is historical—it is in the records of the House of Commons and in the department over which I preside—that the chief of the department at that time, Mr. Paige, who was a very able man, decided that in enlarging the Welland Canal it would be fifty years before it would be found necessary to enlarge it again.

"Now, let me tell you this, because perhaps it is a secret that has been kept but is not now any longer necessary to keep. When it was decided by the Government to proceed with the enlargement of the Welland Canal we never let it be known, at least we could not emphasize the fact—of course we took the ground that it was intended to bring those vessels from Port Arthur to Kingston, but we always had in mind that as soon as we got them to Kingston we could then start and enlarge the St. Lawrence so that we could bring them through to Montreal.

"If it had not been for the five long years of war, gentlemen, let me tell you you would be bringing your seven, or eight, or ten thousand-ton vessels to Kingston, but not only that, the scheme between Prescott and Montreal would be under way with a view of canalizing the St. Lawrence River.

Vessel Tonnage

"We, in Canada, had, prior to the war, in 1913, 1,200,000 registered tonnage. I know that a good many Canadian registered vessels were lost during the war, many more probably than is generally realized, and, on this account, the latest figures might have been expected to show a decrease. But I was agreeably surprised to see by the Marine and Fisheries reports that instead of 1,200,000 tons we have increased our tonnage to 1,475,000 tons, or a quarter of a million tons more than we ever had. And I also want to say this, that when we come to the end of the present year we will probably have made that nearly two million tons, and it is gratifying to me to know that to-day we stand eighth among the largest ship-owning countries of the world, and at the end of this year it is believed that we will be fifth in that class.

"Now, Mr. President, as I stated, it is very gratifying to me to know that in our inland waters, years ago, when I first entered Parliament, about 1,200 tons was the largest vessel that we had in Canada, and to-day I should say we have on the Upper Lakes vessels of 12,000 tonnage, and we are able to use them at a profit.

"I want to be in a position if I can, before I pass away from this life, to be able to say that I can get on the Government railway system, go to Vancouver, and get on a Canadian-owned, built and controlled steamer, built in Canada of Canadian products, by Canadian workmen, and travel right straight around the world on Canadian property."

PROPOSED DEEP WATER CANAL

A scheme which is of utmost and vital importance to the city of Ottawa, and of huge interest to Canada at large, was submitted last week to the attention of the Joint International Commission on the improvement of the St. Lawrence waterways.

The scheme, which was authorized by Mr. Noulin Cauchon, a civil engineer of Ottawa, involves practically making the city of Ottawa a deep-water sea port. Starting at Cardinal, on the St. Lawrence, Mr. Cauchon would build a canal through to the Ottawa River, entering the latter seven miles below this city, through Green's Creek. The Ottawa River would then be used as planned out for this particular portion of the Georgian Bay canal proposal. The St. Lawrence route would then be taken at Montreal, and thence proceed through to the ocean.

The Ottawa River would then be dredged from the entering point of the new canal to the city of Ottawa, thus allowing deep-water drawing boats to reach Ottawa city.

Mr. Cauchon points out the fact that several locks would be needed in the performance of his scheme, amongst other places at Green's Creek where there would be a drop of 105 feet to reach the level of the Ottawa River.

If the scheme was carried out, declares Mr. Cauchon, the result would prove a real bonanza for the city of Ottawa, and give a stimulating energy to the general industry and trade in the eastern part of Canada.

Special Rules for Masters' and Mates' Examinations

Seamen and Those Who Have Served in Naval Vessels Will be Granted Special Facilities in Sitting for Their Examinations for Coasting and Inland Waters

OWING to the very low standard of service qualifications for certificates of the above grades, namely, two years' sea service to qualify for Mate and then one year's service as Mate with a Mate's certificate to qualify for Master, as compared with four years' sea service to qualify for a Board of Trade certificate as Mate in the home or coasting trade of the United Kingdom, and then one year as Mate with a Mate's certificate to qualify for Master, no reduction in the length of sea service required by the regulations can be made.

Service in the army and time spent in nautical schools will not be accepted as qualifying for examination.

Service in naval vessels, including vessels working in connection with the navy, will be accepted under the following conditions:—

Mate's Examination

1. The whole of the time spent at sea in a capacity where a knowledge of seamanship was being acquired will be accepted as qualifying for Mate's examination.

2. Half the time spent on naval vessels in port will be accepted as qualifying for Mate's examination provided that no length of such time shall be allowed to count for more than one-quarter of the total time required for a Mate's certificate.

Master's Examination

1. The whole of the time spent at sea as Mate or Master, or in a corresponding capacity, whilst in possession of a Mate's certificate, will be accepted as officer's service to qualify for Master's examination.

2. Half the time spent on naval vessels in port in one or other of the above capacities or in a corresponding capacity, whilst in possession of a Mate's certificate, will be accepted as officer's service to qualify for Master's examination provided that no length of such time shall be allowed to count for more than one-quarter of the total officer's service required.

A candidate for examination must always produce the "Service Certificate" of his commanding officer, showing the particulars of his service, etc., and must, in addition, produce any other particulars respecting his service which the examiner may require.

DISCIPLINE AND ORGANIZATION

There is no place where discipline and organization are more needed than on board ship, and particularly on a passenger ship. The history of the sea is replete with instances of coolness and heroism in circumstances of great danger which are directly traceable to the influence of discipline. Anybody who has been at sea knows that the happy ship is the one where the discipline is never relaxed, and where the men respect the officers, and the officers the men. In the ship where weakness is evident in the higher command, there is nothing but slackness and discontent down the line, even to the trimmers in the bunkers. Orders are carried out with a display of reluctance, or, in some cases, are wilfully neglected, and every order has to be repeated three or four times before action is secured. In the weakly disciplined ship, the sea lawyer flourishes, and eagerly discusses the pros and cons of every order given. The fault usually lies with the skipper. If he is firm, he keeps his officers up to the mark, and they, in turn, keep the bo'sun and crew on their toes. The ship always presents a trim appearance, and is in the state known as ship-shape and Bristol fashion at all times. Men move to the word of command with a snap, the daily work goes on, and, in time of emergency, everything is in the appointed place, and every one knows his job. In the case of the slack ship, everything is handy and nothing on top, like a midshipman's chest. When anything is wanted in a hurry, there is running around and confusion, coupled with angry recriminations as to whose particular fault it is that the necessary equipment is not at hand. The scene is one to inspire anyone used to a well-disciplined ship with disgust.

Keeping discipline is purely a personal matter. True, there are laws that can be invoked, but the ship's master or officer who is not strong enough to maintain his authority without constantly logging, or threatening to log, his men will never make a success. He must be able to make them understand that he is in command, and that what he says goes. As the old Yankee bucko-mates used to say: "When I say walk, I mean run; and when I say run, I mean fly." Don't pay too much attention to a sailor's complaints. Remember that a sailor, like a farmer, has the privilege of growling. As long as he works, let him growl all he likes. It eases his mind, and doesn't interfere with the ship's business. If he has a legitimate complaint, see that it is remedied. The sailor or fireman is a human being, though there are a few shipmasters and officers who do not admit this. Never lose your temper with a man. It puts you at a disadvantage. Be firm, but fair. Have such a knowledge of your business that the men will know that you know, which goes a long way with a good man. Before you give a command, make sure that it is the right one, and don't change your mind when it's half done. Never get familiar with the men, as it is true at sea, as ashore, that familiarity breeds contempt. Always maintain your dignity, which entails always being courteous to those above and below you. Conduct yourself always so that you will be entitled to be known as an "officer and a gentleman." Then will you be happy, and those under your command contented and efficient.

ANNUAL MEETING OF THE C.M.S.G.

At a meeting of the management committee of the C.M.S.G. held at Collingwood on Jan. 20, with Capt. R. D. Simpson in the chair, and representatives from Toronto, Midland, Owen Sound, and other points, it was arranged to hold the annual meeting in Toronto. The date was not set, but each member of the C.M.S.G. will be notified and the announcement made in the "Review."

The management of the Guild are determined to sail the ship to victory.

At the annual meeting there are several matters that will be taken up of vital importance to the Guild and to the marine in general, and it will be the endeavor of the Guild to affiliate, if possible, with other branches of the Guild, say at British Columbia, and also the Masters' and Mates' Association at Halifax, and if the constitution of our organization can be made, or is made on the lines of the C.M.S.G. in this district, it was hoped that much benefit could be derived from such, and the Guild, with a Parliamentary committee, which it is hoped will be established in the near future to facilitate the legislative that is necessary to further the interests of the C.M.S.G.

The secretary is particularly anxious that there should be a full attendance of members, and that they should watch the "Review" for the announcement of the date of the annual meeting, as well as to make any inquiries to headquarters if they wish.

MARINE ACADEMY, COLLINGWOOD

Classes in steamship and navigation are in full swing at the Academy and much educational work has been done.

The engineering class also seems to be appreciated by the prospective marine engineer officers, and also by the younger men, who have the opportunity of attending a special class for the preliminary work.

The class rooms that have been secured are well-lighted and well-heated, and our lake men have the opportunity to study for their certificates in such a manner that they have never had before.

LAST MUNITION BOARD SHIPS DELIVERED

The handing over of the "War Vixen" and "War Magic" in Halifax last month marked the final of the Imperial Munition Board's marine activities in Canada. The ships built here for the board, both wood and steel, made up a very respectful tonnage, 349,163 to be precise.

It may be remembered that the shipbuilding programme of the Imperial Munition Board was started in 1917, and soon after its commencement Col. W. I. Gear assumed control, his title being Director of Steel Shipbuilding.

The first steel ship was the "War Dog," launched August 6, 1917, from the Wallace Shipyards Ltd., Vancouver, while the first wooden ship was the "War Sioux," built by the Great Lakes Dredging Co., Port Arthur, delivered in September, 1918.

The total wooden tonnage was 142,600, and the steel tonnage 206,563, all deadweight measurement.

THE "IMPERATOR" ARRIVES IN THE MERSEY

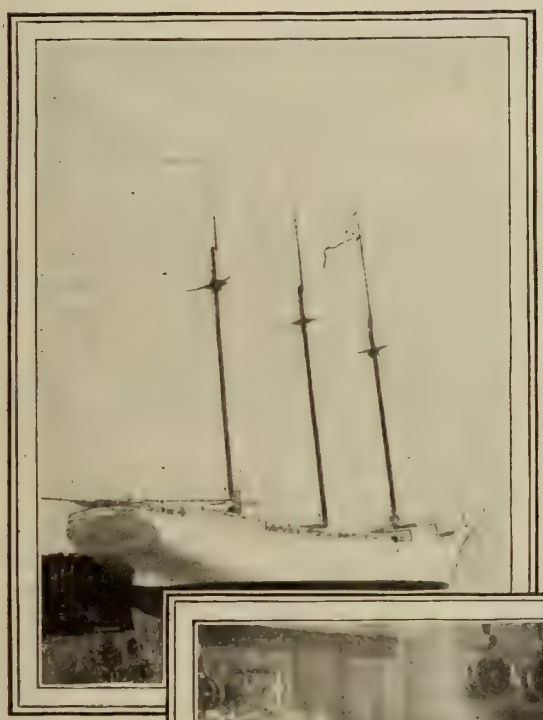
Having at last secured possession of the famous "Imperator" from the United States authorities, the Cunard Line have sent the vessel round to the Mersey to be refitted. She will be put in the Gladstone Graving Dock in Liverpool, and the overhauling and repairing will be carried out by Messrs. H. & C. Grayson, who have the distinction of being the oldest firm of shipbuilders, repairers and engineers in the port. This firm had the docking of the "Leviathian" and "Aquitania," so have had some experience in handling these marine monsters. After the "Imperator" leaves the Mersey, she will be operated between Southampton and New York. It may be interesting to recall the dimensions of this vessel, which has been so much in the public eye since her surrender by the Germans. She was built in Hamburg, at the Vulcan Works, in 1912. She is quadruple screw, turbine, 882.9 feet long, 98.3 feet beam, and 57.1 feet deep. Her tonnage is 51,969 gross, and 23,205 net register.

Halifax.—Speaking at a dinner of the departmental heads of the Halifax Shipyards, J. E. McLurg, general manager of the yards, said: "We are builders, not bankers." He was speaking of the building of French ships, orders for which could be obtained in quantities if it were not for the adverse rate of exchange. Payment for these orders would be made in French bonds, but not at the existing rates of exchange. Mr. McLurg said that the French interest wanted the bonds to be accepted at a rate to be agreed upon, but that the yards could not entertain such a proproposal. He added that the Halifax Yard would be the best in Canada, eventually, and the equal of any on the Atlantic coast.

Newfoundland to Greece in 23 Days

This is the record of the auxiliary Schooner "Samuel Courtney" and Mr. S. Courtney, her master, attributes it to her

Fairbanks-Morse "C. O." Engines



Auxiliary Motor Schooner "Samuel Courtney," 1918, equipped with 2-100 H.P. Fairbanks-Morse type "C.O." Semi-Diesel Crude Oil Engines.

Twin Screw, 7 Knots, 531 Gross Tons, 441 Net Tons, 171' long, 35' beam. Geo. M. Barr, Owner; Sam'l M. Courtney, Master; O'Brien Noel, N.S., Builder.

Fairbanks-Morse C.O. Engines have proved their economy, made possible by their using low priced fuels, and now the long distance speed record has been established. Each C.O. —30 to 200 H.P.—gives perfect regulation under all loads.

The Canadian Fairbanks-Morse Co.
Limited

Halifax St. John Quebec Montreal Ottawa Toronto Hamilton Windsor
Winnipeg Saskatoon Calgary Vancouver Victoria

Marine News From Every Source

Toronto.—The famous old "Chicora" has been sold to a Toronto barrister, Mr. Frank W. Callaghan, for $4,400. It is understood that she will be repaired and put in service on one of the passenger routes from Toronto.

Guysboro, N.S.—The steamer "Scotian" from Halifax, was the first steamer to arrive in the port for nearly a month. She was able to reach the mouth of the harbor only, and discharged her freight on the ice, from which it was removed by team to the port, half a mile away.

Chicago.—The seamen on the Great Lakes are demanding an eight-hour day, and it is expected that the next two or three weeks will see them take action to secure it. Their present hours are twelve hours a day at sea and nine hours a day in port.

Mr. Roy Burgeon, well known on the lakes as the chief engineer of the Canada Steamship Lines steamer "Rochester," died recently of pneumonia. His funeral was held from the residence of his parents, Chaumont, N.Y. Deceased was 33 years of age and was working on the ship's boilers at Erie, Penn., when he contracted his fatal illness.

Ottawa.—The International Joint Committee have made restrictions on the pollution of international waters by discharge from vessels plying on them. All vessels operating on international waters must provide equipment for disposal of sewage and garbage, the restrictions applying particularly to the Detroit and St. Marys River.

Brockville.—The steamer "Valcartier" has been purchased by the Montreal Transportation Company from the Algoma Central Steamship Lines of Sault Ste. Marie. The "Valcartier" was formerly owned at Cleveland, Ohio, where she was built in 1903, her name then being the "W. H. Mack." Her new owners will place her in service on the lakes and river, and are said to be looking round for more bulk freighters.

Montreal.—The Fracanda Line, which is the Compagnie General Transatlantique, will shortly start a service from Canada to Bordeaux direct. The Canada Steamship Lines are agents for the French line here, and they state that the first sailing will be made about February 24 by the steamer "Wisley," and sailing will be monthly thereafter. If conditions warrant the service will be increased to twice a month.

Prescott.—The Prescott & Ogdensburg Ferry Co. are remodelling their steamer "Miss Vandenberg" so that she will accommodate ten automobiles per trip. The new steamer "Ferdinand" will be put in commission this summer whenever the traffic conditions warrant, and the combined car-handling capacity of the two steamers will be 65 per hour. The company expect a largely increased traffic to follow the construction of highways in the Province.

May Sell Polson's—G. T. Clarkson, liquidator, notified the courts that he has successfully completed the contracts the Polson Iron Works had on hand, and asked leave to advertise the company's property for sale, as a whole or en bloc. The matter came before Mr. Justice Middleton at Osgoode Hall and the required permission was given.

G. D. Robinson, who was for twenty-five years with the Canadian Pacific Ocean Service, and European freight agent when he severed his connection recently, has now opened offices in the Coristine building, Montreal, room 511, where he will carry on a business of steamship freight broker, shipping, forwarding and chartering agent.

Montreal.—Capt. W. Gerrard, secretary of the Canadian Association of Shipbuilders and Engineers, is busy on the campaign of organization of that body, and is meeting with great success. The leading firms of the country are anxious to get such an organization built up, feeling that it will have a beneficial influence on the industry in many ways.

Plate Mill Starts.—The new plate mill of the Dominion Steel Company at Sydney, N.S., has been completed, and active operations have been started. The first plates turned out were in every particular equal to those made by American mills, and measured up to the highest requirements of Lloyds. The Deputy Minister of Marine, Alex. Johnston, was present when the mill was formally opened. He stated that he believed this undertaking was the beginning of big things for that section of Canada.

Montreal.—When the steamships "War Vixen" and "War Magic" were delivered at Halifax in the month of January, the completion of the Imperial Munitions Board programme was marked. The number of vessels turned out under this programme was 46 wooden vessels of 142,600 tons d.w., and 42 steel vessels of 206,563 ton d.w. The operations were conducted under the seal of secrecy as far as was possible, and no definite information as to the extent of the programme was published until recently.

Mr. Percival Cort, late of the British Corporation, has joined the firm of William C. Wilson, Toronto, and will take charge of the marine engineering department of that firm. Mr. Cort was with the British Corporation for twelve years, the most of this period being spent in Glasgow. He has been their representative in Toronto for several years and is well known to the shipping fraternity.

Detroit.—Figures for the 1919 season for the Soo Canal and Detroit show that an average of one vessel passed Detroit every 20¾ minutes. Vessels passing Detroit, upbound, numbered 6,938, and downbound 9,447. The tonnage passing through the Sault Ste. Marie Canal was 68,285,542, being greater than the tonnage passing through the Suez Canal.

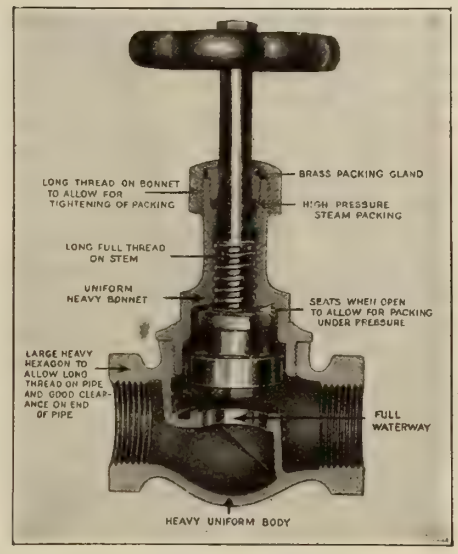
Travel Cost Goes Up.—The excursion lines on the American side of the Great Lakes are planning to raise their fares for the coming season. One of the leading excursion lines in Detroit, through their traffic manager, made the following statement: "Detroit is the principal tourist town on the Lakes, an average of 15,000,000 passengers being carried from here each season. Last year very few lines paid dividends and some just came out even. Receipts were larger, but operating expenses were larger still."

Canada Steamships Extending.—The Canada Steamship Lines are going to enter the immigration service with the opening of navigation. Mr. Harry W. Cowan, director of operations for the company, has returned from a three months' trip to Europe, and reports that he has made arrangements for this service. The company will put on two 12,500 ton steamers between Montreal and French and Belgian ports, and will inaugurate services to the Mediterranean and South America.

High Exchange Hurts U. S.—The new American merchant marine is suffering through the high price of the dollar. While exchange was near the normal level, Britain and European countries were chartering American ships to bring over grain, etc., but with the lowering in value of the pound sterling the cost of American tonnage became prohibitive. For instance, with exchange at a rate that made one pound worth four dollars, a freight rate of $40 a ton from the U. S. to Europe represented a rate of 200 shillings per ton. With the pound only worth $3.40, the same rate required

"The Valve O'Nine Points"

THERE are nine outstanding features of the "EMCO" Composition Disc Valve—plainly shown in the accompanying illustration — which in themselves are sufficient reasons why this valve is superior to any other.


LONG THREAD ON BONNET TO ALLOW FOR TIGHTENING OF PACKING
BRASS PACKING GLAND
HIGH PRESSURE STEAM PACKING
LONG FULL THREAD ON STEM
UNIFORM HEAVY BONNET
SEATS WHEN OPEN TO ALLOW FOR PACKING UNDER PRESSURE
LARGE HEAVY HEXAGON TO ALLOW LONG THREAD ON PIPE AND GOOD CLEARANCE ON END OF PIPE
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Made of the best Bronze Metal, each Valve is subjected to a thorough hydraulic test before it leaves the factory.

We can make prompt deliveries. Write for prices, etc.

Empire Manufacturing Company, Limited

London and Toronto, Canada

NOTICE TO MARINERS
No. 2 of 1920
(Atlantic No. 2)

All bearings, unless otherwise noted, are given from seaward in degrees from 0° (North) to 360°, measured clockwise, followed by the magnetic bearing in degrees in brackets, miles are nautical miles, heights are above high water of ordinary spring tides, and all depths are at low water of ordinary spring tides.

NEW BRUNSWICK

(4) Bay of Fundy—Grand Manan Island—Swallow-tail Lightstation—Fog Bell to be Moved

Former notice.—No. 149 (497) of 1914.

With a view to increasing the audibility of the fog signal at Swallow-tail lightstation, to the northward and westward, the bell, which is now situated 450 southerly from the lighthouse will be moved, in the near future, to a position in closer proximity to the lighthouse.

Authority.—Report from Superintendent of Lights, St. John.

Admiralty charts.—Nos. 2539, 2013, 352, 1651 and 2670.

Publication.—Nova Scotia and Bay of Fundy Pilot, 1911, page 278.

Canadian List of Lights and Fog Signals, 1919.—No. 17.

Departmental File.—No. 20017F.

NOVA SCOTIA

(5) South Coast—Whitehaven Harbor—Unchartered Shoal

Position.—4½ cables 348° 30′ (N. 13° E. mag.) from the most easterly extreme of Deming Point. East tangent of Fisherman Island in line with west tangent of Sheep Island.

The following sextant angles fix the position of the shoal: East tangent of islet at entrance to Marshall Cove, 0°; west tangent of Fisherman Island, 43° 06′; south tangent of the most southerly Harbour Island, 129° 49′; Whitehead Island Lighthouse, 162° 49′.

Depth.—15 feet.

Description.—Shoal of small extent, smooth rock sloping off gradually on all sides to 6 fathoms.

Variation in 1920.—24° 20′ W.

Authority. — Report from hydrographer, Department of the Naval Service.

Admiralty charts.—Nos. 2560, 2517, 729, 1651 and 2666.

Publication.—Nova Scotia Pilot, 1911, page 56.

Departmental File.—No. 49641.

NOVA SCOTIA

(6) Cape Breton Island—Sydney Harbor—Southeast Bar—Emergency Light to be Placed in Old Lighthouse

Former notice.—No. 16 (39) of 1912.

Owing to the pier at Southeast Bar Lightstation having been damaged by storms it may be found necessary to suspend the operation of the light on short notice, and if so, a temporary light will be exhibited from the old lighthouse and the fog bell discontinued.

Position of old lighthouse.—On point 1,300 feet 112° 30′ (S. 41° E. mag.) from the present light. Lat. N. 46° 12′ 18″. Long. W. 60° 12′ 55″.

Character.—4th order dioptric fixed red acetylene gas light.

Elevation.—30 feet.

Variation in 1920.—26° 30′ W.

Authority.—Departmental records.

Canadian Naval Chart.—No. 415.

Admiralty Charts.—Nos. 2042, 2687, 2727, 1651, 2516 and 2666.

Publication.—"St. Lawrence Pilot," Vol. 2, 1916, page 42.

Canadian List of Lights and Fog Signals, 1919.—No. 472.

Departmental File.—No. 20472R.

PRINCE EDWARD ISLAND

(7) East Coast—Souris East Breakwater Light Moved

The Souris East breakwater light has been moved to a new position 60 feet from the outer end of the breakwater.

Authority.—Report from agent, Department of Marine, Charlottetown.

Admiralty Charts.—Nos. 2034, 1651, 2516 and 2666.

Publication.—"St. Lawrence Pilot," Vol. 2, 1916, page 166.

Canadian List of Lights and Fog Signals, 1919.—No. 679.

Departmental File.—20679C.

NEW BRUNSWICK

(8) East Coast—Miramichi Bay—Portage Island Front Range Light—Day Beacon Established

Position.—On southern end of island. Lat. N. 47° 9′ 43″. Long. W. 65° 2′ 25″.

Description.—Diamond-shaped wooden slatted daymark on front range pole.

Color.—White.

Authority.—Departmental records.

Admiralty Charts.—Nos. 2187, 2034 and 1651.

Publication.—"St. Lawrence Pilot," Vol. 2, 1916, page 275.

Caandian List of Lights and Fog Signals, 1919.—No. 867.5.

Departmental File.—No. 20867R.

A. JOHNSTON,
Deputy Minister.

Department of Marine and Fisheries,
Ottawa, Canada, 4th Feb., 1920.

No. 3 of 1920
(Inland No. 1)

ONTARIO

(9) Detroit River, Lower End—Bar Point—Lightship to be Established

Date.—Opening of navigation, 1920.

Position.—At junction of Amherstburg and Livingstone Channels, in position formerly occupied by the United States lightship. Lat. N. 42° 2′ 32″. Long. W. 83° 8′ 0″.

Description.—The lightship is a wooden schooner with two masts. The hull is painted red with "Bar Point No. 21" in white letters on each topside. There is a red ball near the top of the foremast. If for any reason the lightship is off her station the ball will be lowered.

Lights.—The illuminating apparatus is dioptric and consists of three fixed white lights encircling the foremast, visible all around the horizon and elevated 30 feet above the water.

Fog Alarm.—During thick or foggy weather a steam whistle will give a blast of 10 seconds duration every 40 seconds, thus:

Blast	Silent interval
10 secs.	30 seconds

Authority.—Departmental records.

Admiralty charts.—Nos. 332.

Publication.—U. S. H. O. Publication No. 108C. 1907, page 16, and U. S. Lake Survey Bulletin No. 28, page 446.

Canadian List of Lights and Fog Signals, 1919.—To be inserted as 1875.

Departmental File.—No. 21875M.

ONTARIO

(10) Lake Superior—Thunder Bay—Port Arthur Harbor—Buoy to be Moved—Buoy to be Discontinued

Date.—Opening of navigation, 1920.

Buoy moved.—Red spar buoy No. 8A, on north side of channel, immediately inside the breakwaters at the main entrance channel will be moved to a new position 150 feet 350° (N. 11° 30′ W. mag.) from the lighthouse on the north breakwater.

Buoys discontinued.—Red spar buoys Nos. 2A and 4A on the north side of the channel at the entrance to the main harbor will be discontinued.

Variations in 1920.—1° 30′ E.

Authority.—Departmental records.

Canadian Naval Charts.—Nos. 114 and 101.

Publication.—U. S. H. O. Publication No. 108 A. 1906, page 82; and U. S. Lake Survey Bulletin No. 28, page 111.

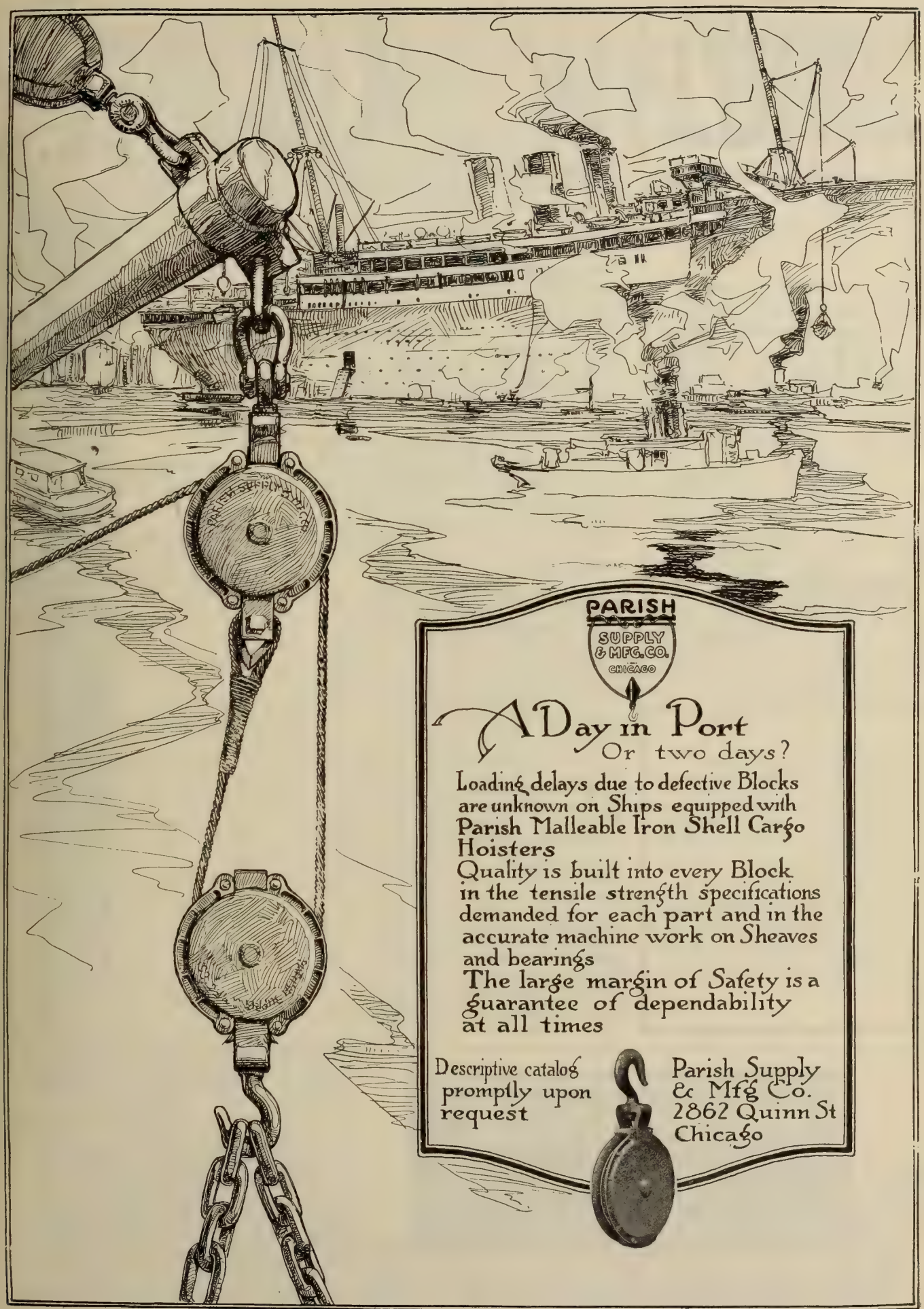
Departmental File.—29214.

A. JOHNSTON.
Deputy Minister.

Department of Marine and Fisheries,
Ottawa, Canada, 5th Feb., 1920

Pilots, masters or other interested are earnestly requested to send information of dangers, changes in aids to navigation, notice of new shoals or channels, errors in publications, or any other facts affecting the navigation of Canadian waters to Chief Engineer, Department of Marine and Fisheries, Ottawa, Canada. Such communications can be mailed free of Canadian postage.

Ottawa. — The fifteenth bi-annual meeting of the Grand Council of the National Association of Marine Engineers of Canada has just been completed at the Windsor Hotel, Ottawa. After hearing an address from P. M. Draper, secretary of the Trades and Labor Congress, on the benefit of affiliating, the Council decided to take the step. Representations will be made to the Government to adjust the rates of pay on Government steamers, so that they will be equal on the Atlantic and Pacific coasts. Engineers coming from the Pacific coast find that they have to accept lower rates of pay on the Atlantic coast, or else pay their own expenses back to their home port. The wages on Government boats as compared to those on private-owned vessels will also be discussed with the Government.



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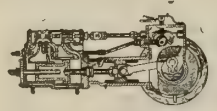


The Patent on a continuous impulse REVERSIBLE GENERAL PURPOSE INTERNAL COMBUSTION ENGINE, adapted for Marine use, inexpensive to build and most economical to use. Patented, Canada, Jan. 18, 1916, No. 167188. Patented in England, Sept. 11, 1912, No. 20762. Address W. T. Smith, 633 Arlington Ave., Lockland, Cincinnati, Ohio, U.S.A.

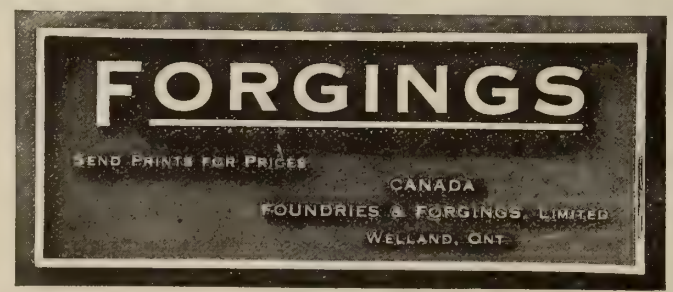
Manager wanted, for Canadian National Newspapers & Periodicals Association. To act also as Secretary-Treasurer, and carry on the Association's general work, under the direction of the President and the Board of Directors, study the interests of the various classes of publications in the Association, and plan and carry on promotion work in their interests. Applicants should understand advertising and merchandising. Apply in writing only, stating age, full details of experience, and salary expected. Applications will be treated as confidential. Address Acton Burrows, President, Canadian National Newspapers & Periodicals Association, 70 Bond Street, Toronto.

According to figures obtained from the Department of Marine and Fisheries, there were built in Canadian shipyards last year 80 vessels which were sent overseas without being registered here. A considerable proportion of these vessels were constructed for French interests and there were several for the Imperial Munitions Board, as well as two or three for Norway. The total net tonnage of these ships that left the country was 99,340. They were divided into three categories; wooden sailing ships, wooden steamships and steel steamships. Of wooden sailing ships there were only two constructed; these were produced by Nova Scotia and were of 747 net tonnage.

In wooden steam vessels there was quite a good showing, the number built being 60, with a total net tonnage of 68,522. Of these British Columbia sent the largest share, the number being 43, and net tonnage 50,660. Quebec province came next with ten, New Brunswick with five, and Nova Scotia turned out two ships of this class, while Ontario built none.

Of steel steamships there were 18 constructed, with total net tonnage of 30,071. In this class Ontario had an output of 8, giving total net tonnage of 6,083; Montreal built 7, but with total net tonnage of 11,265; while British Columbia, although it turned out only 3 ships, produced total net tonnage of 12,723.

These figures relate only to ships constructed in the year 1919 to overseas orders. The orders for the Imperial Munitions Board were all executed under the director of shipping, Col. W. I. Gear, vice-president of the Robert Reford Company, Ltd., who, it is understood, gave his services to the Government. An order from the French Government for fifty wooden vessels for use on the Mediterranean explains the activity of Pacific Coast yards and of Quebec yards in the matter of wooden shipbuilding. The Quebec orders were filled by Fraser Brace & Company at their plant on the Lachine Canal, and also by the Tidewater Shipbuilding Company at Three Rivers.



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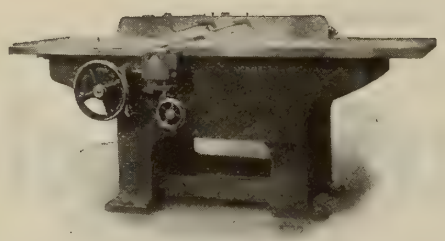
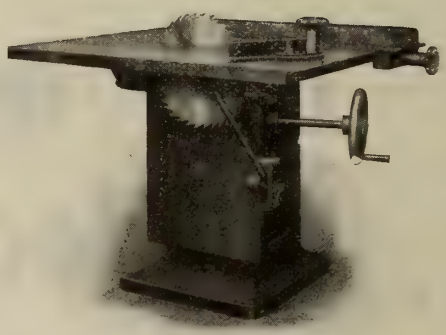


No. 199—BUZZ PLANER



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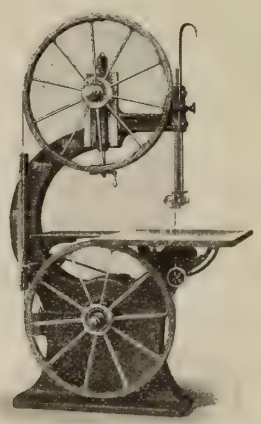

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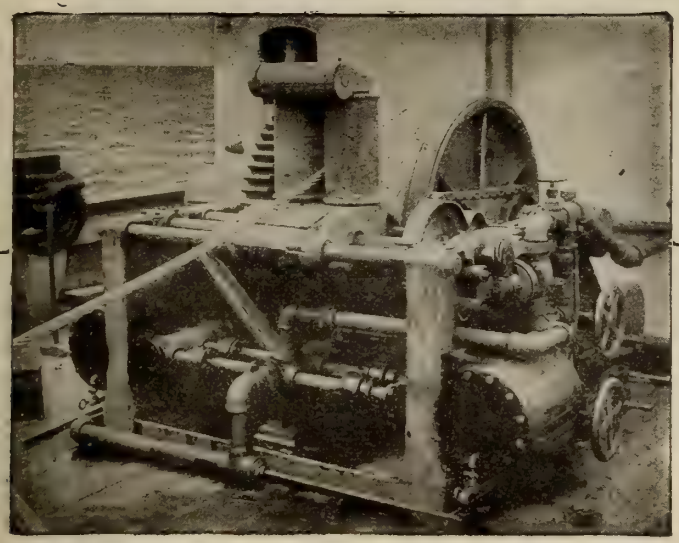

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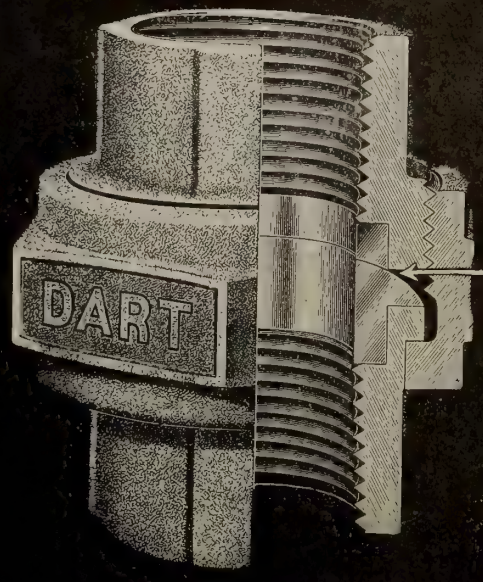

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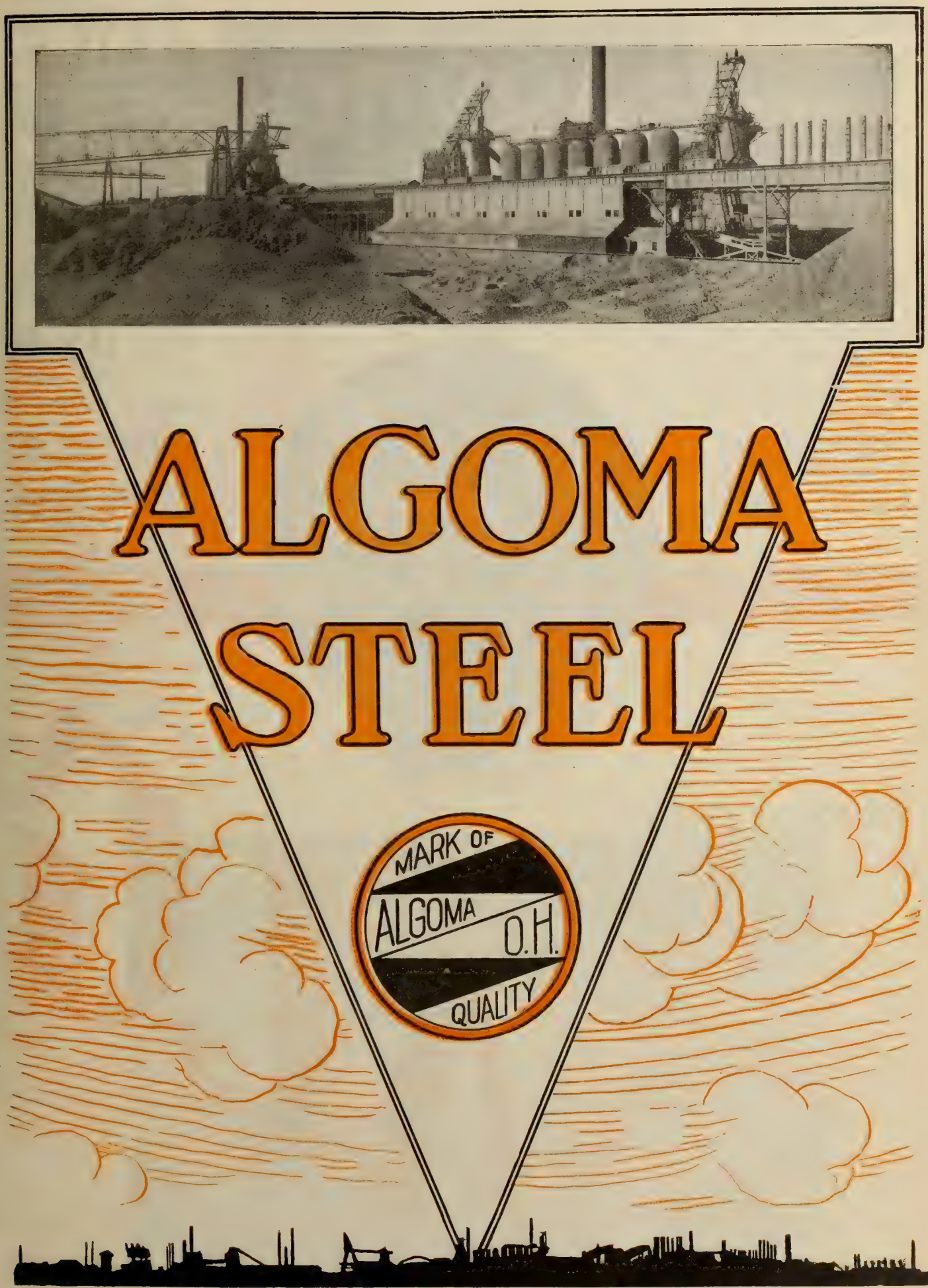
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3 5/16 x 5 1/16 x 3 5/16 x ⅜".
3⅜ x 5⅛ x 3⅜ x 7/16"
3 1/16 x 4 x 3 1/16 x ¼"
3⅛ x 4 1/16 x 3⅛" x 5/16"
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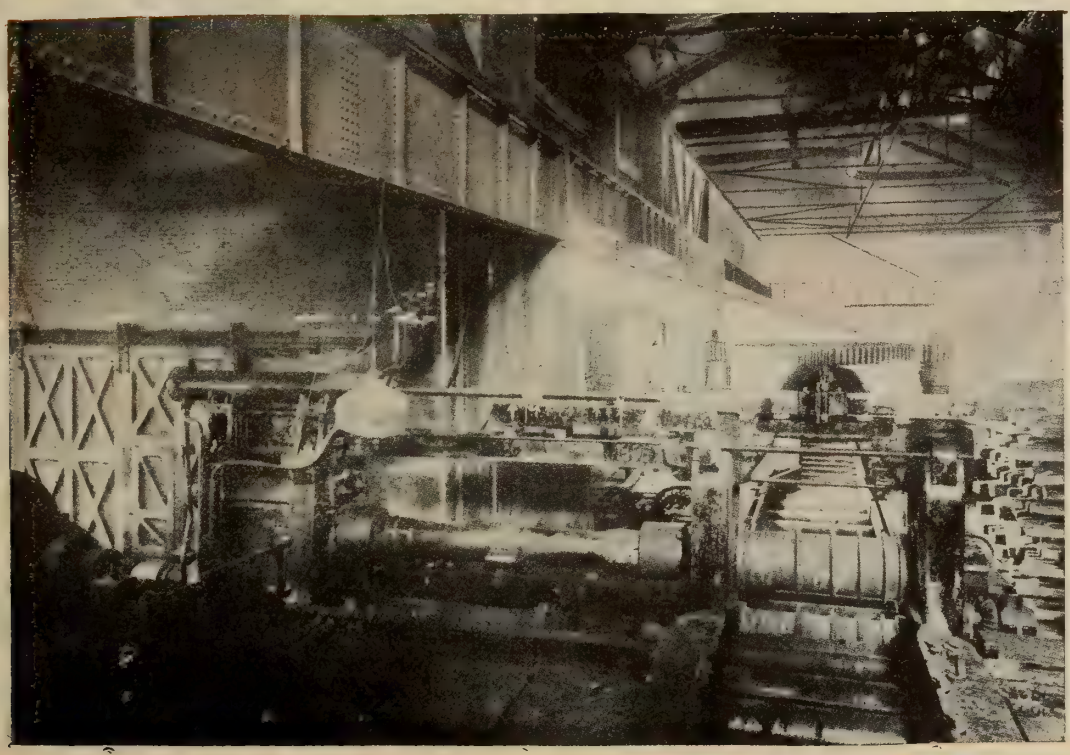

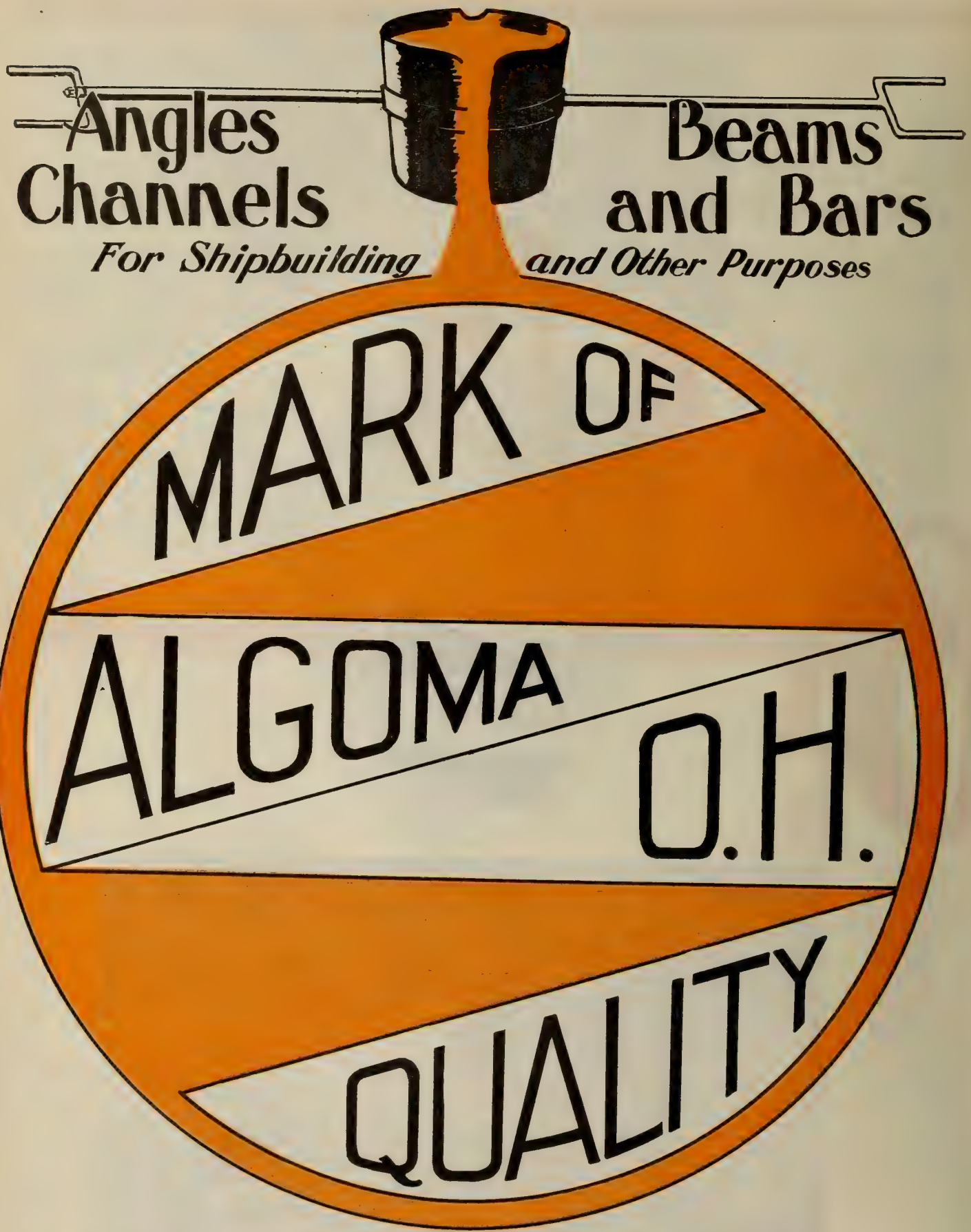

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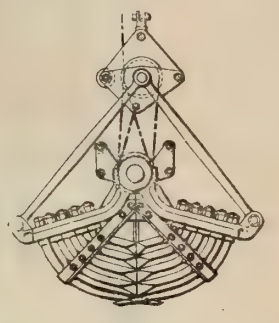

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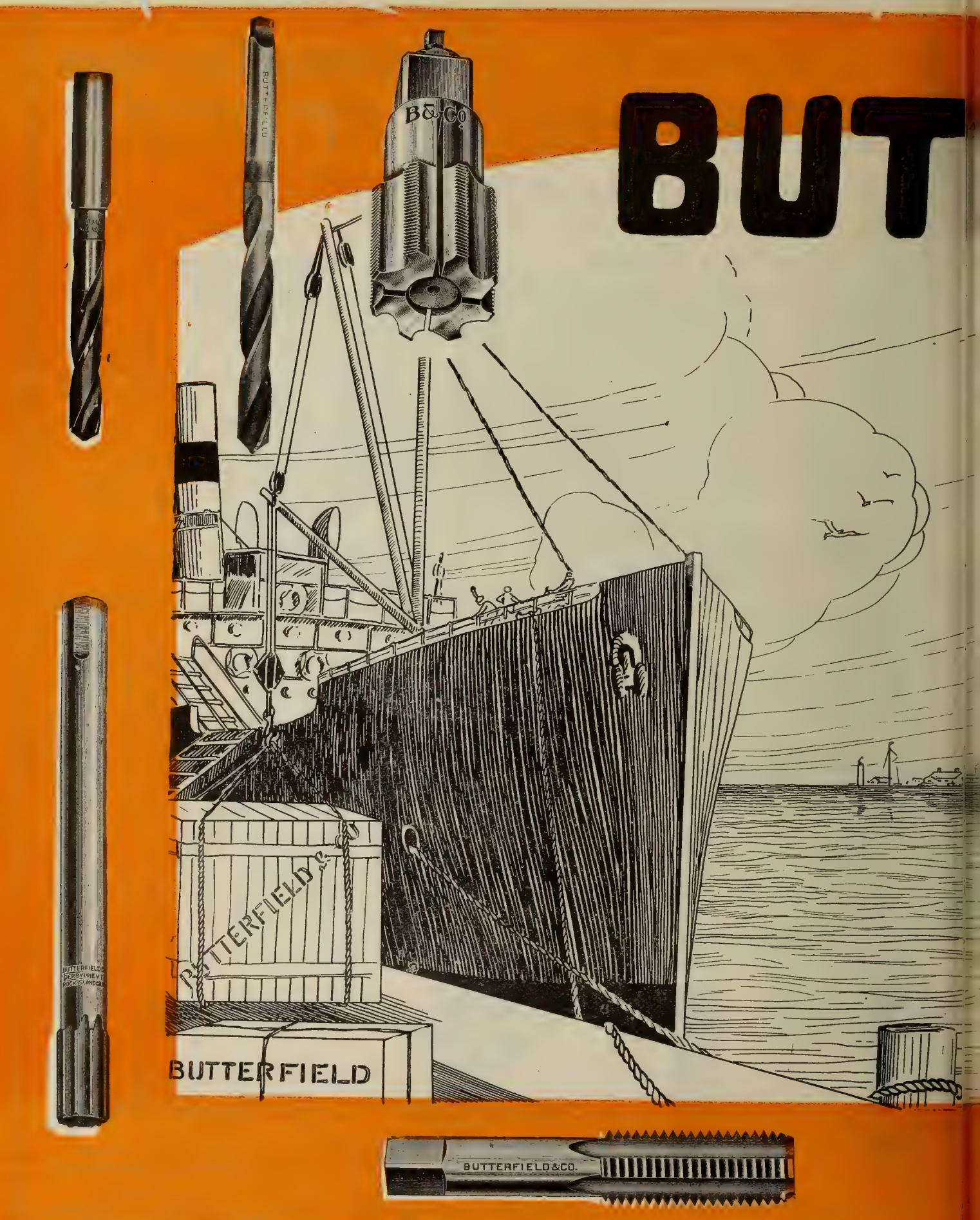
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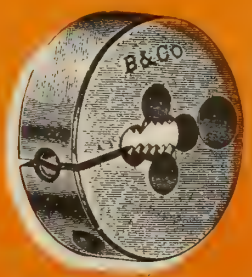

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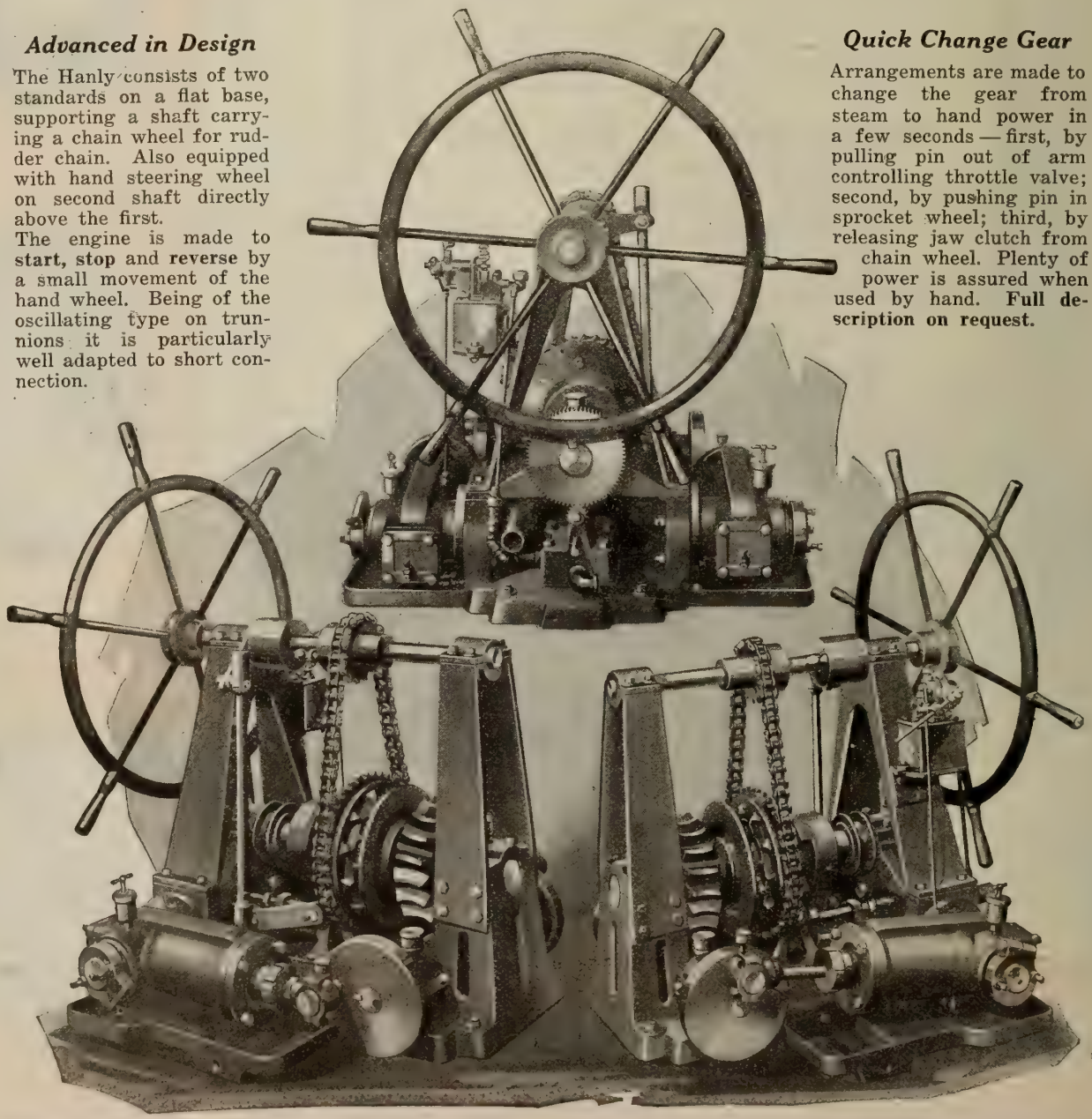

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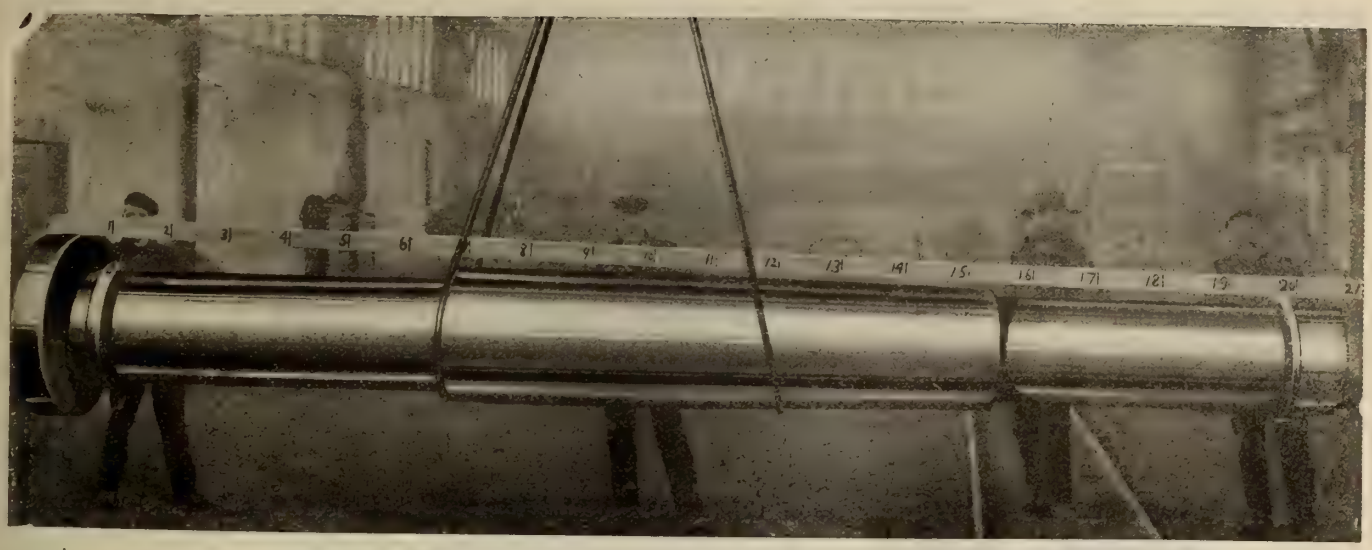
Arrangements are made to change the gear from steam to hand power in a few seconds — first, by pulling pin out of arm controlling throttle valve; second, by pushing pin in sprocket wheel; third, by releasing jaw clutch from chain wheel. Plenty of power is assured when used by hand. **Full description on request.**



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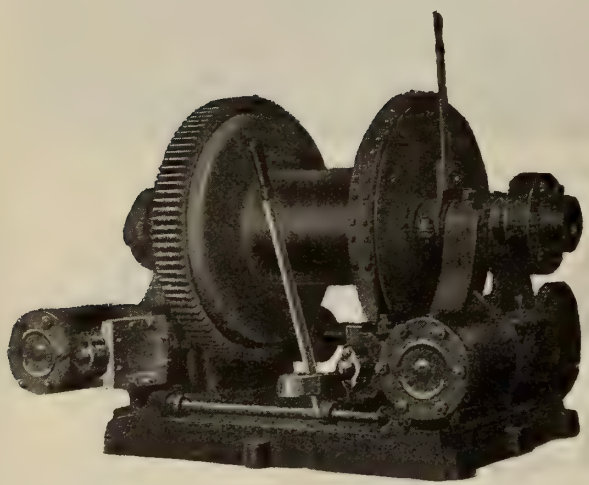

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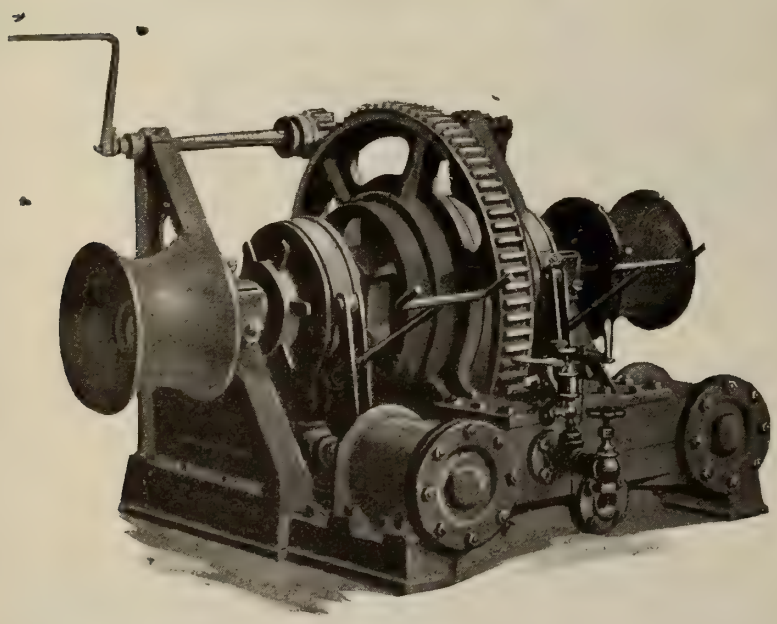

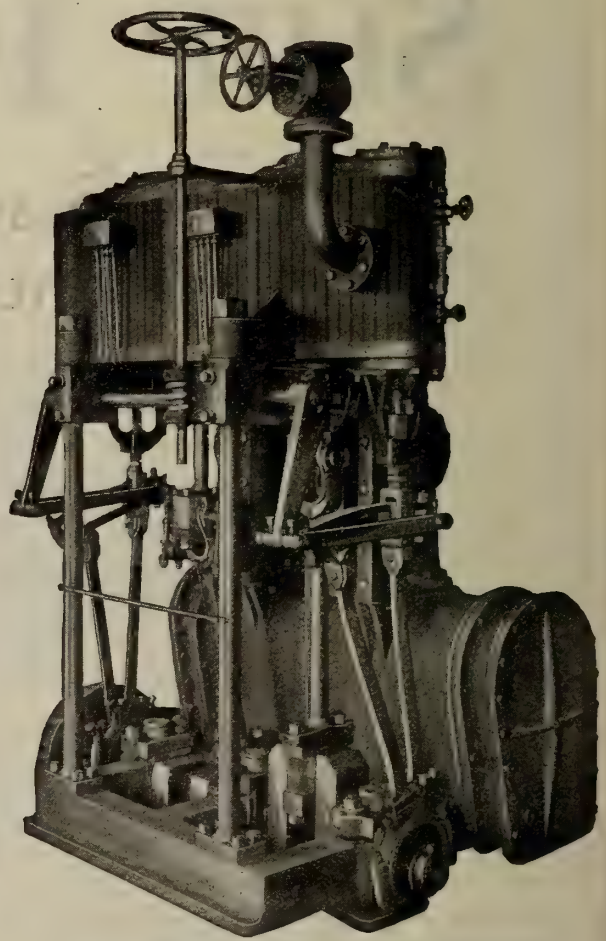

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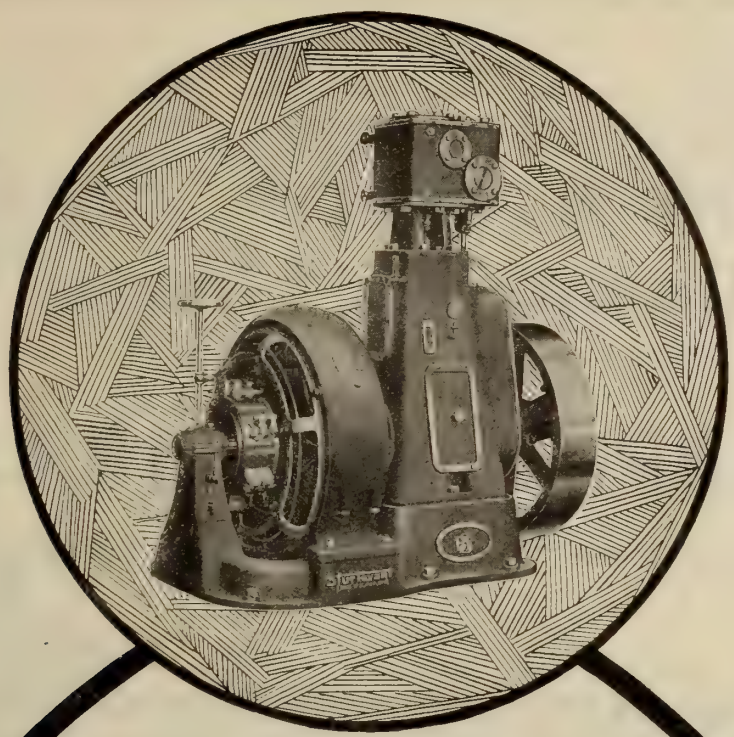

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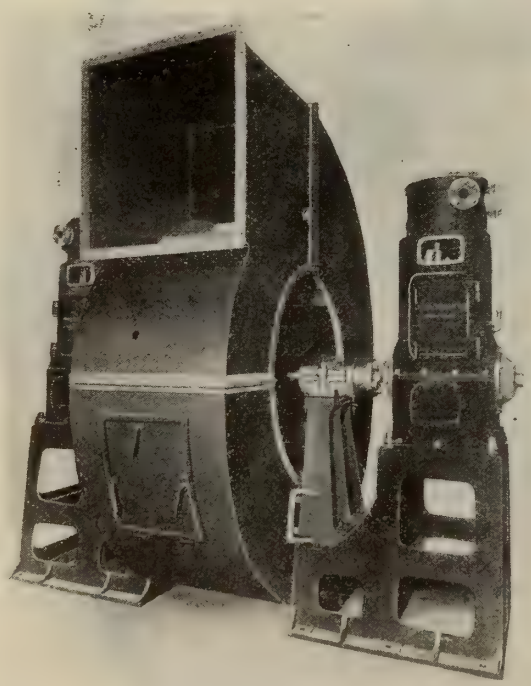

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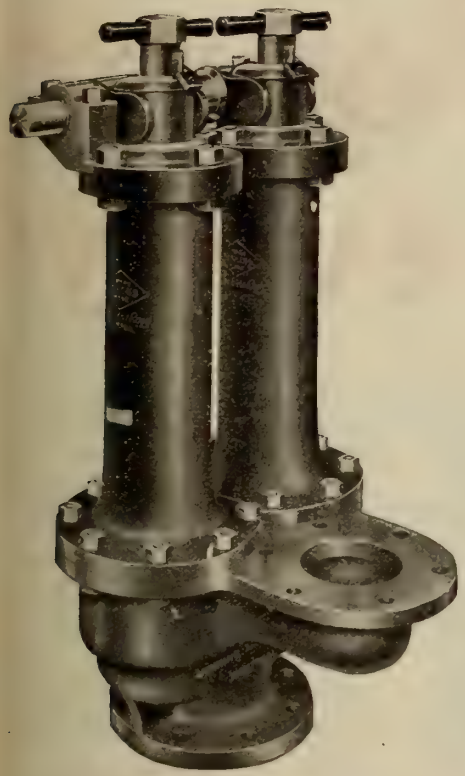

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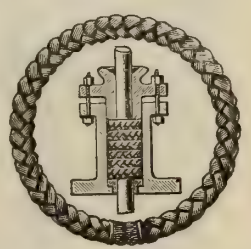

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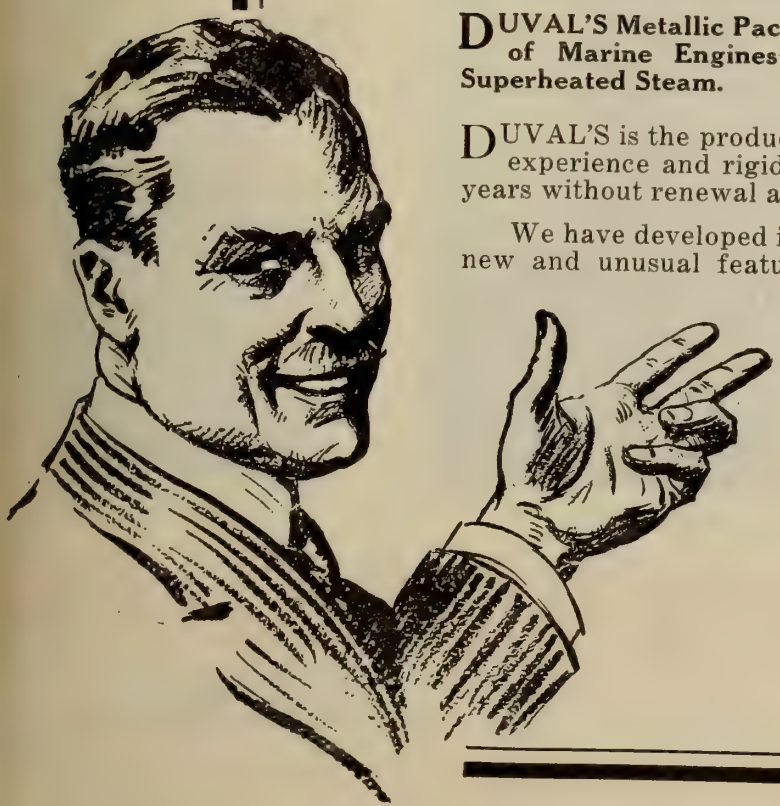

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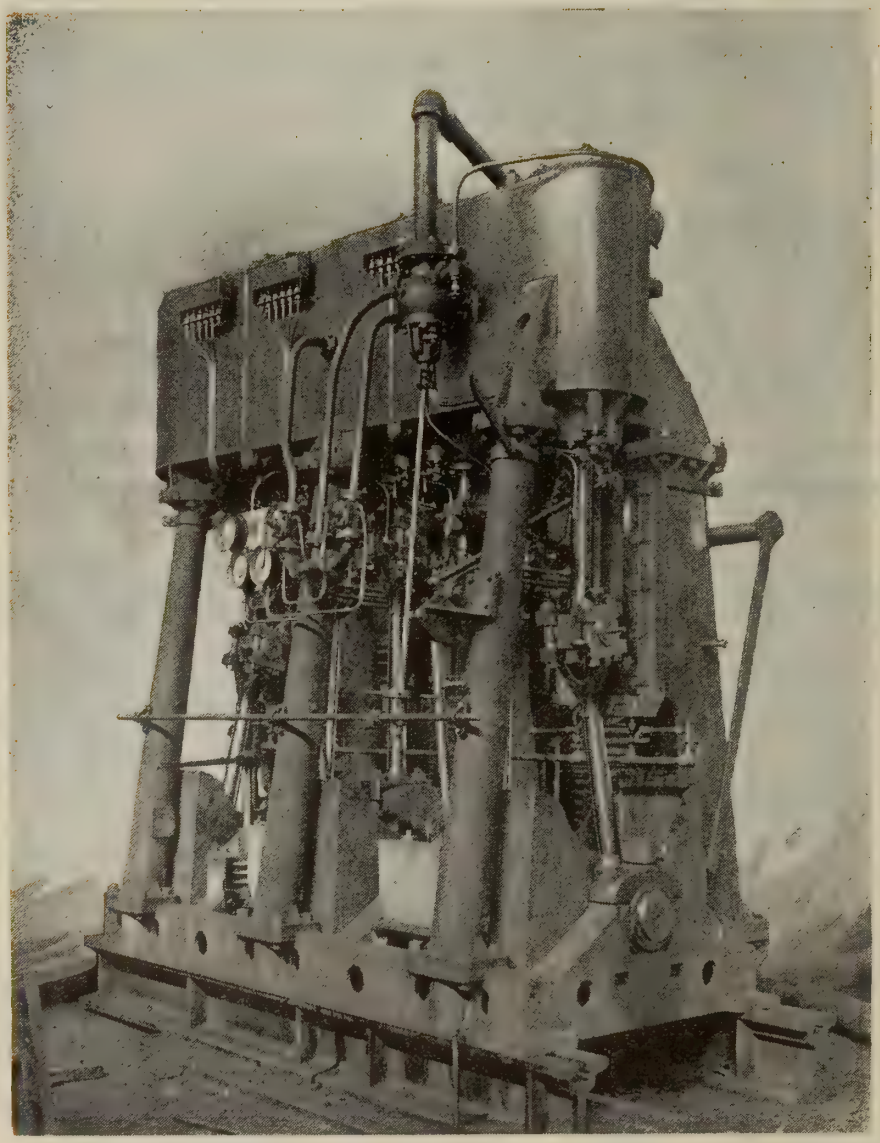

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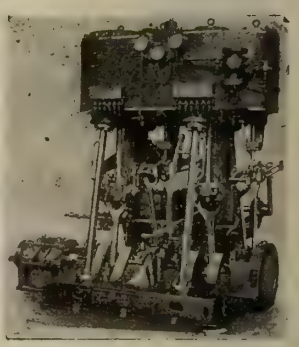

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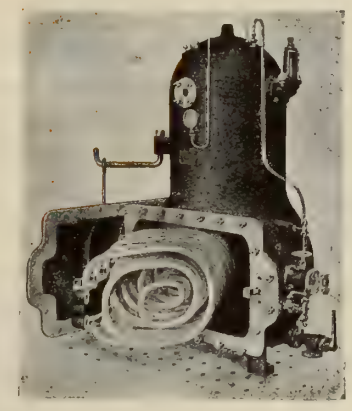
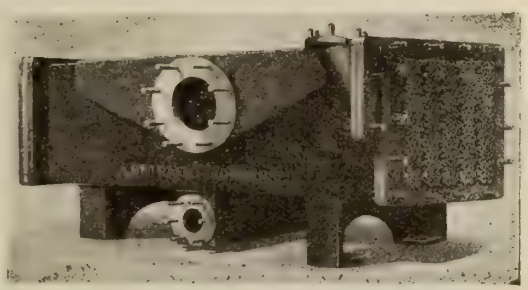
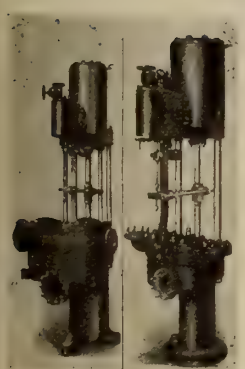
Reciprocating and centrifugal pumps for every marine service---boiler feed, bilge, and ballast.



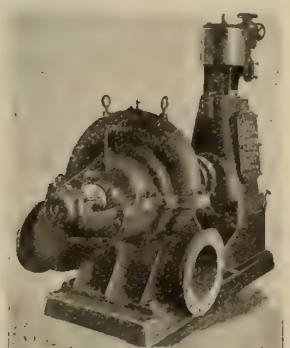
Morrison's Radial Evaporator



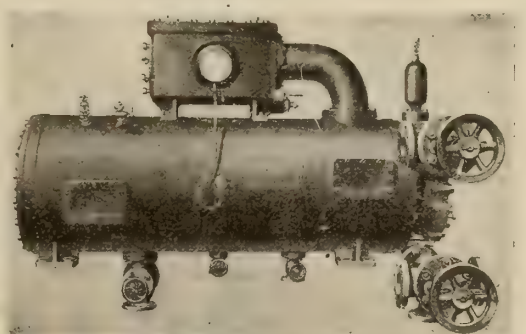
"Contraflo" Auxiliary Condenser



Vertical Marine Pumps



Rees RoTURBo Pumping Unit



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The Growth of the Deadly Drug Habit

IN the year 1912 only 35 ounces of Cocoaine was imported into Canada. Last year the imports had jumped to 12,333 ounces. In 1907 Canadians imported 1,523 ounces of Morphine. Last year we imported 30,000 ounces.

These figures tell a grim story. The drug habit is growing in Canada—growing so fast that it has become a national menace. The war, by teaching the use of opiates, has stimulated the habit and to-day the insidious disease is creeping into our homes and spreading its coils around countless victims. No class is exempt. It strikes everywhere.

Mrs. Murphy (Janey Canuck), police magistrate of Edmonton, has been engaged by MACLEAN'S MAGAZINE to write a series of articles on the danger and the means of checking it. The first article of this series appears in the February 15th issue (now on sale) and it is a powerful appeal for action against "the human canker-worms and caterpillars who fatten and batten on the unfortunate drug addicts"—the men and women who smuggle and sell the drugs. No better person could have been secured to handle this subject, for Mrs. Murphy is not only a powerful writer, but in her official capacity she has had an opportunity to see all phases of the drug traffic. What she writes has the ring of absolute authority.

Other Readable Features of a Strong Number

This, the first number of MACLEAN'S to appear on the semi-monthly basis, is a particularly interesting one. Here are some of the features:—

THE STORY OF THE ALLENS
By Floyd S. Chalmers

How Jule and Jay J. Allen built up their business from a two-by-four theatorium in Brantford, Ontario, to a twenty million dollar string of theatres—the story, in fact, of a business miracle.

THE BLOOD BROTHER
By W. A. Fraser

A strong, short story by the author of "Bulldog Carney" and "Thorobreds."

THE LAND OF NANNABIJOU
By Charles Christopher Jenkins

There's a huge part of Canada that has tremendous possibilities and yet has been neglected, overlooked. Mr. Jenkins tells about it.

THE MANTLE OF ELIJAH
By J. L. Rutledge

An unusual sketch of a politician, Ernest Lapointe, who is regarded as the successor of Laurier as leader of the Quebec wing of the Liberal party—a fascinating bit of inside political gossip.

THE DIAMOND HUNTERS
By Henry P. Holt

An exciting story of two Canadian sailors in the South Seas.

THE THREAD OF FLAME
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A powerful serial story by this famous Canadian author.

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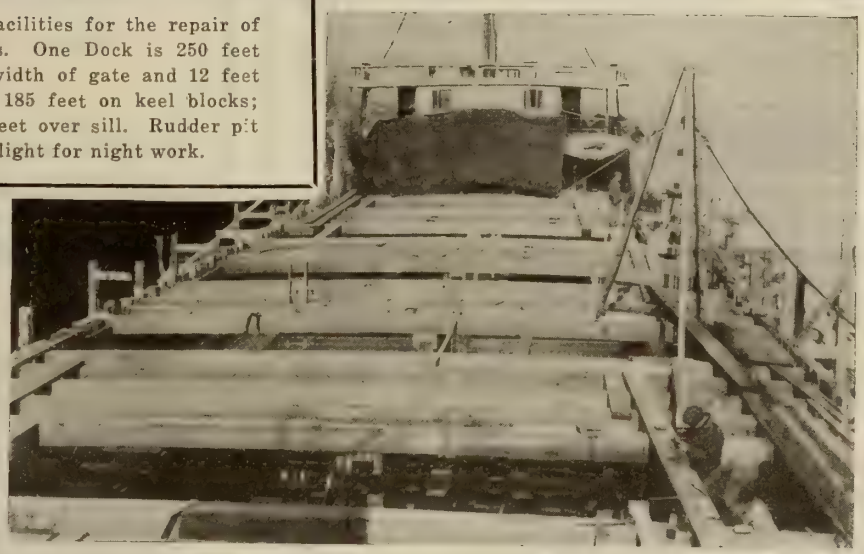

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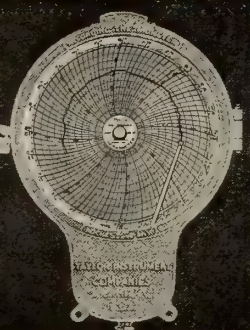

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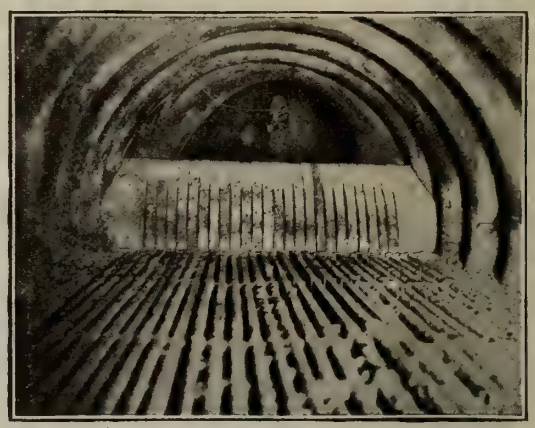

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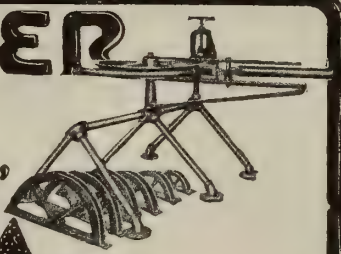

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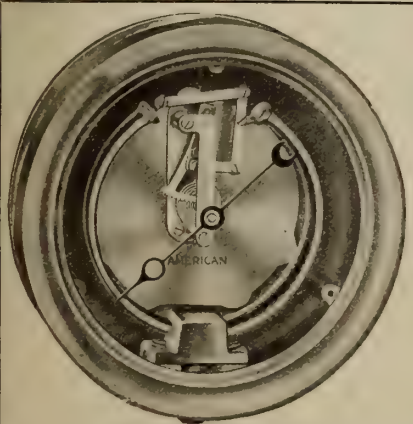

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Lambert, Walter, Montreal, Que.

AMMONIA CONDENSERS
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Taylor & Sons, S., Brierly Hill, Eng.

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ASBESTOS JOINTING
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BARS, GRATE
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Tallman Brass & Metal Co., Hamilton, Ont.

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Quaker City Rubber Co., Philadelphia, Pa.

BELTING, RUBBER
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Parish Supply & Mfg. Co., Chicago, Ill.

BLOCKS, PULLEY, SNATCH, GIN
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Engr. & Mach. Wks. of Can., St. Catharines, Ont.
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Waterous Engine Works Co., Brantford, Ont.

CASTINGS, ALLOY
Tallman Brass & Metal Co., Hamilton, Ont.

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Tallman Brass & Metal Co., Hamilton, Ont.

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Goldie & McCulloch Co., Galt, Ont.
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McNab Co., Bridgeport, Conn.
Tallman Brass & Metal Co., Hamilton, Ont.
Waterous Engine Works Co., Brantford, Ont.

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Mason Regulator & Engin. Co., Montreal, Que.
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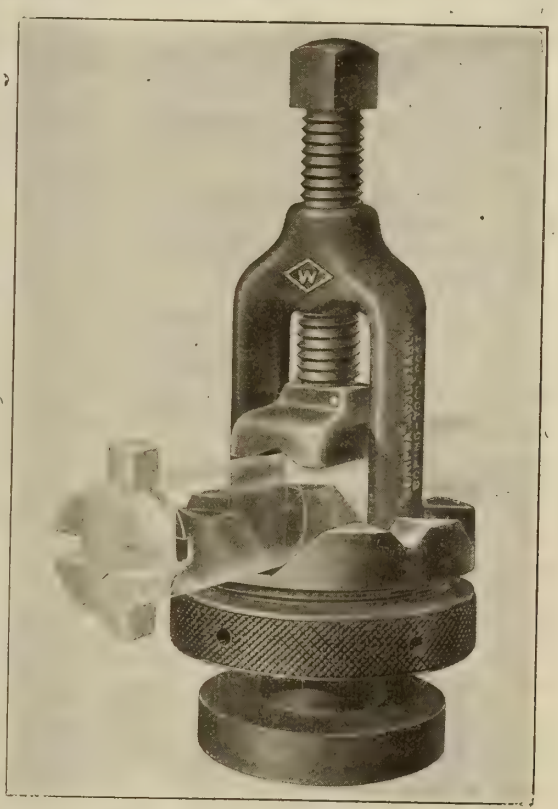

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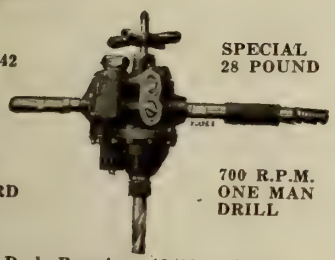

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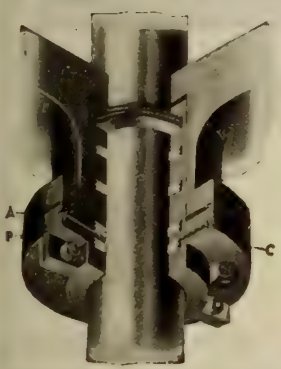

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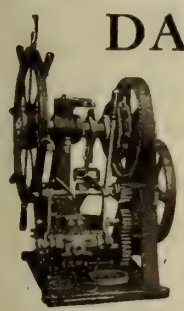

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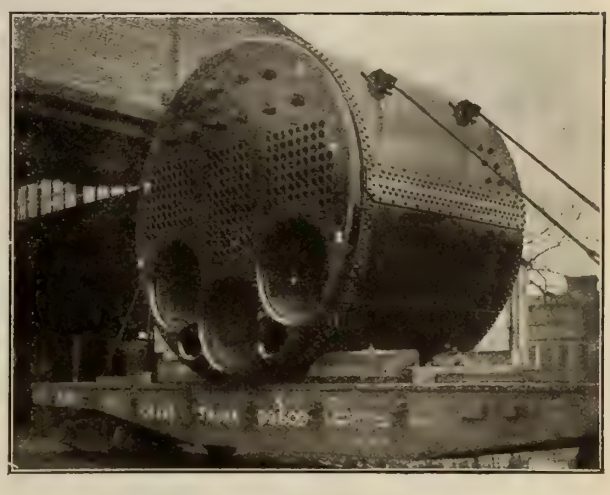

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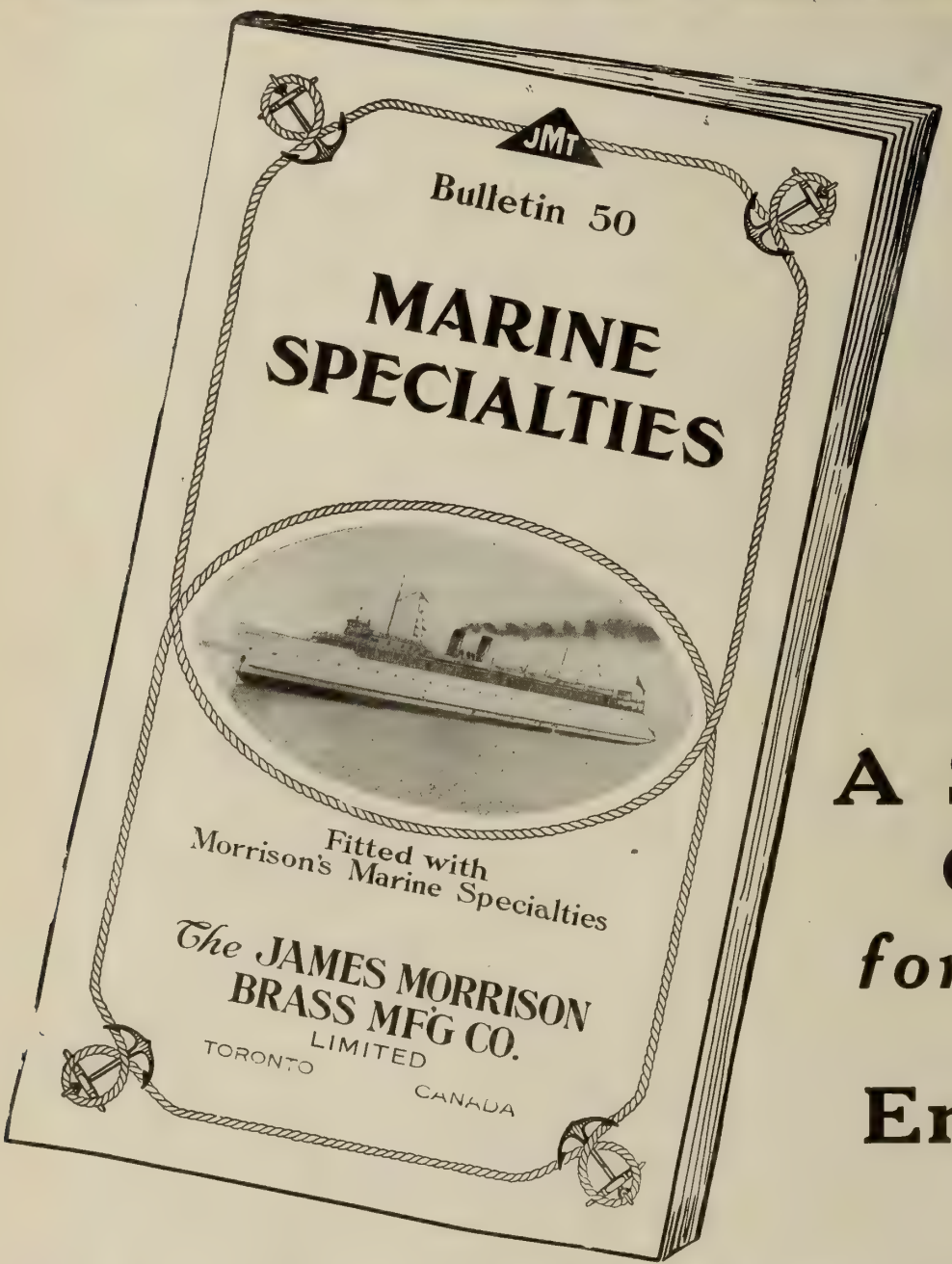

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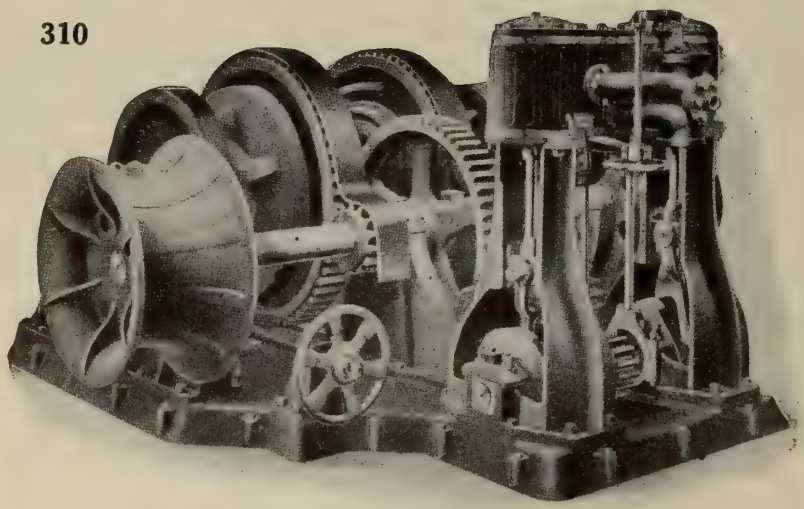

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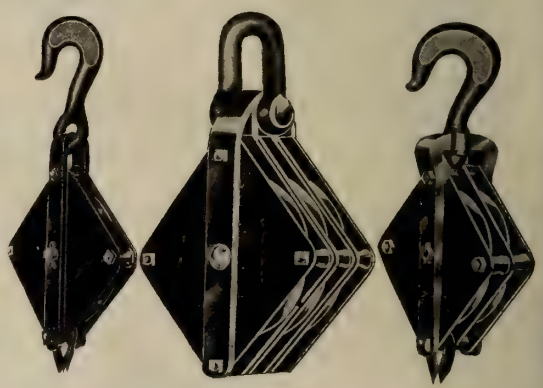

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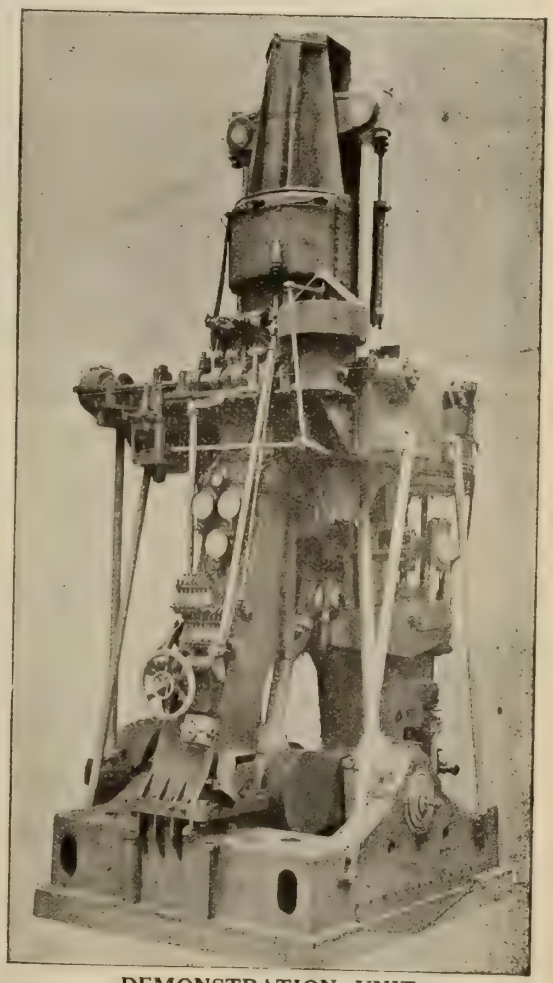

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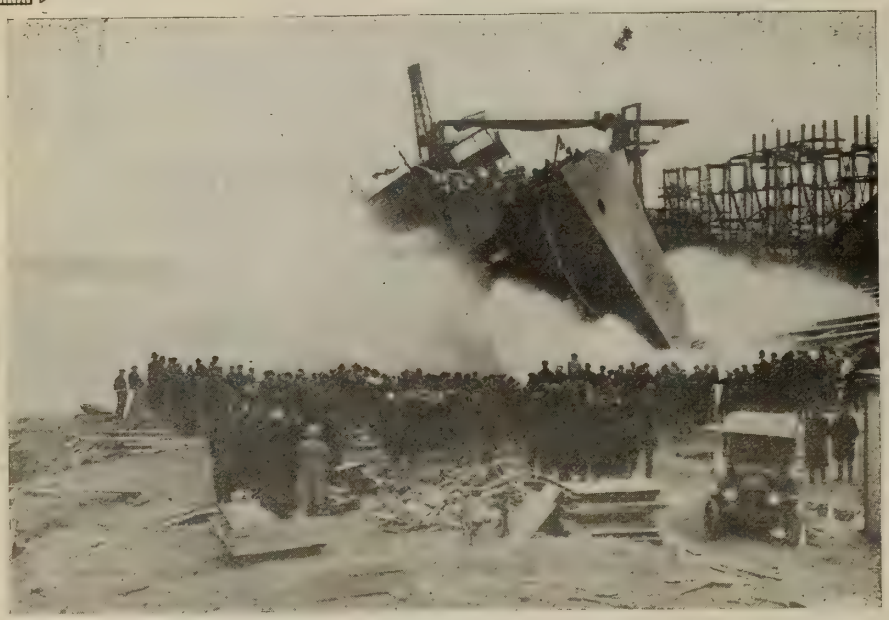

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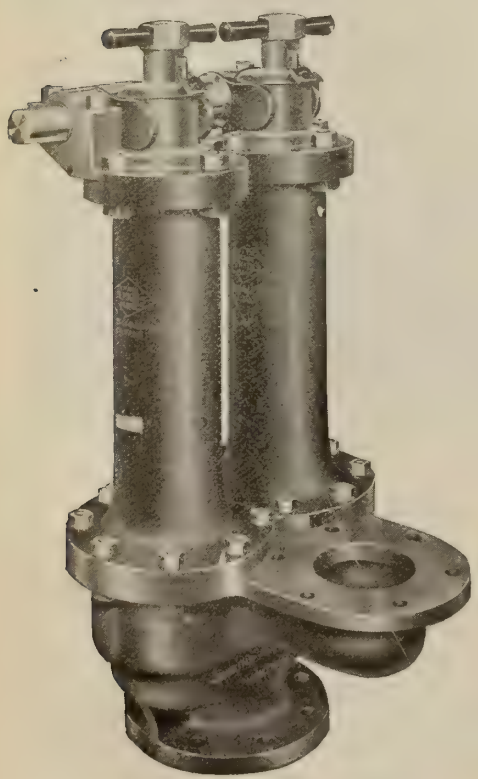

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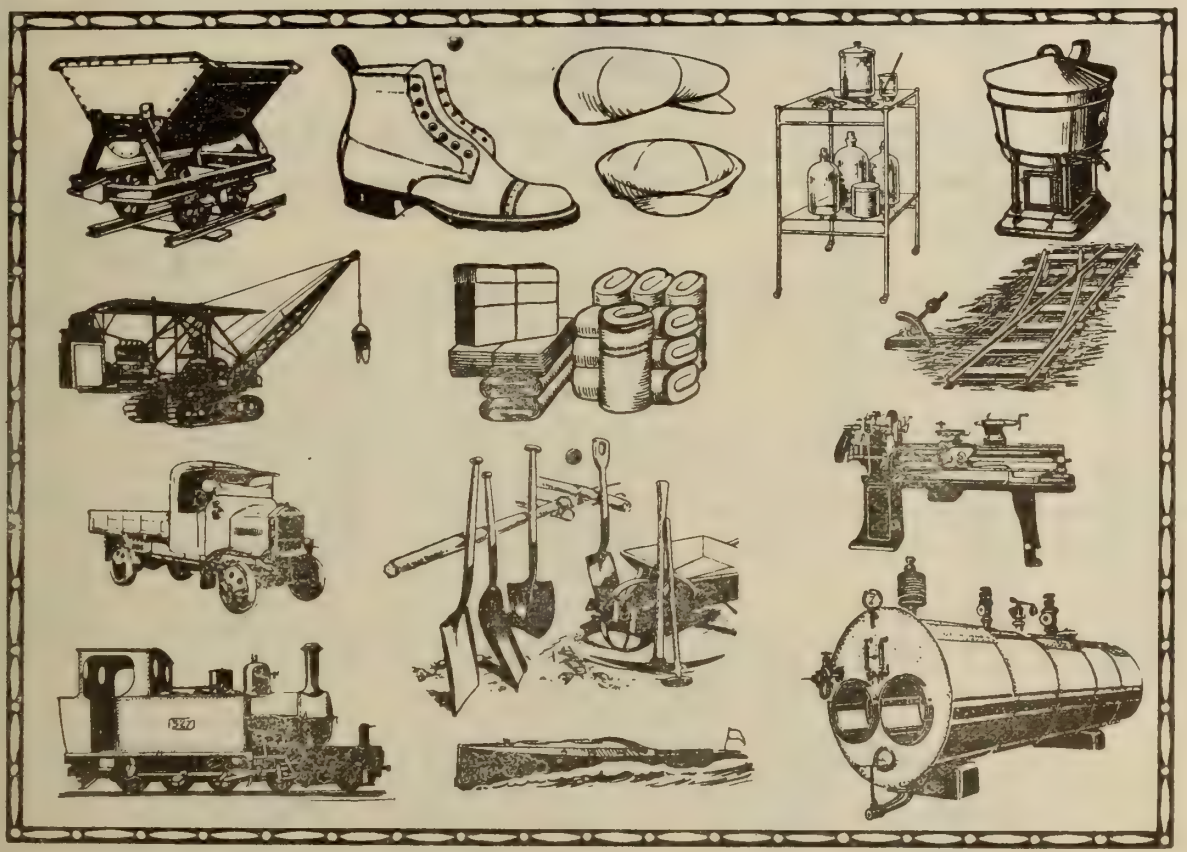

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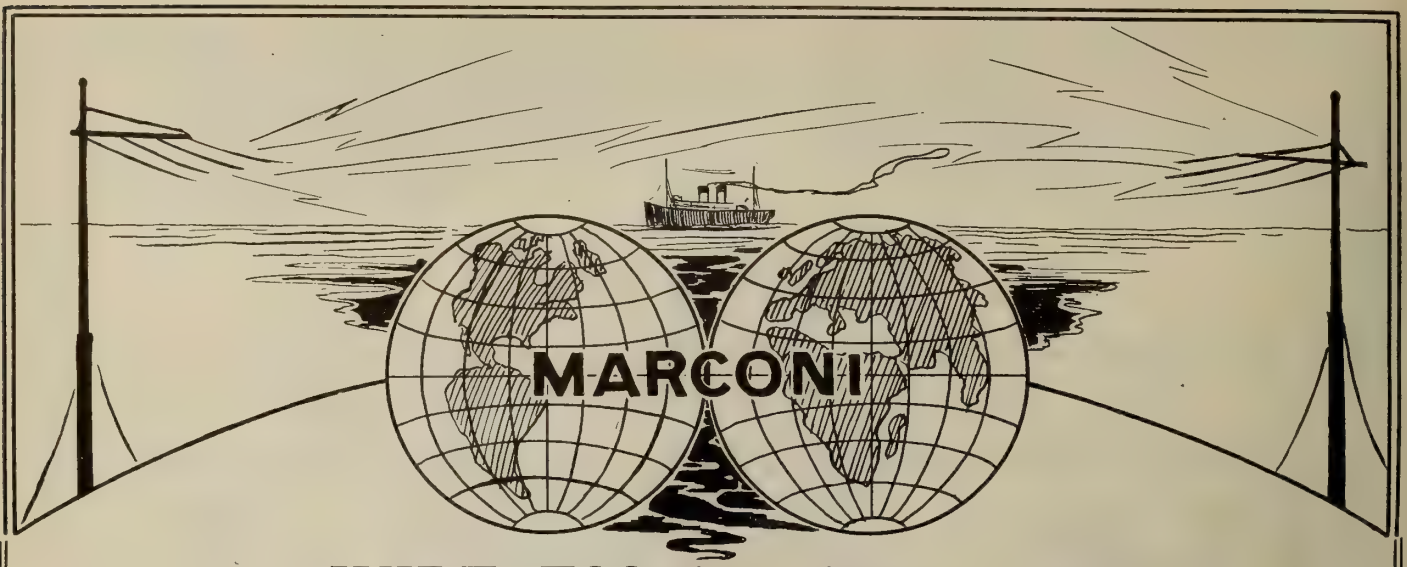

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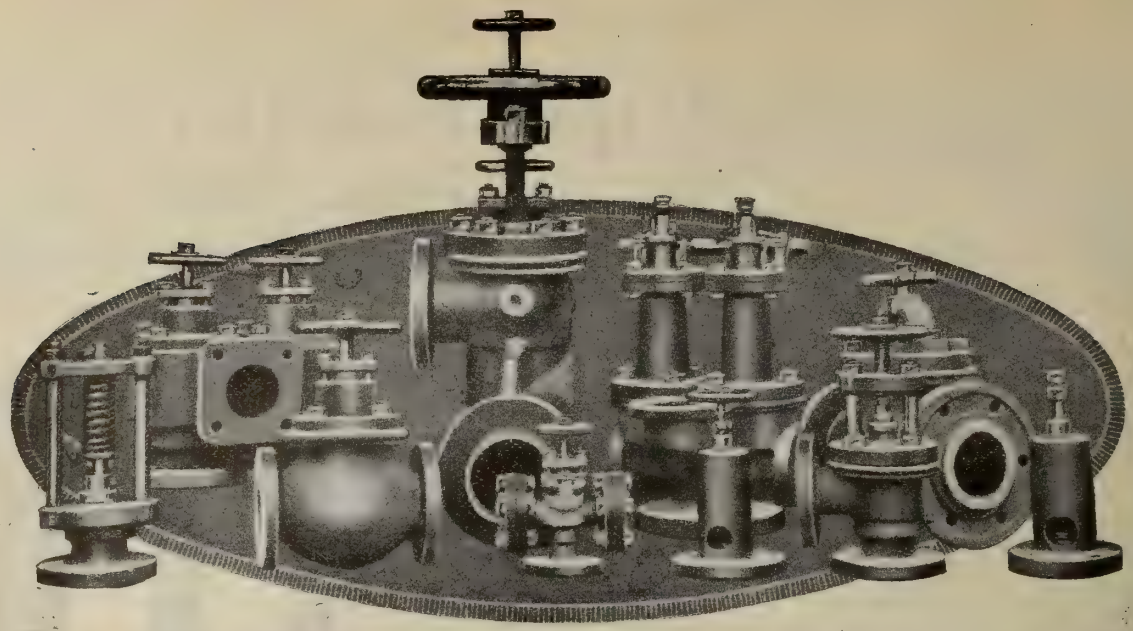

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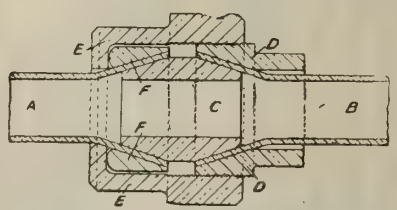

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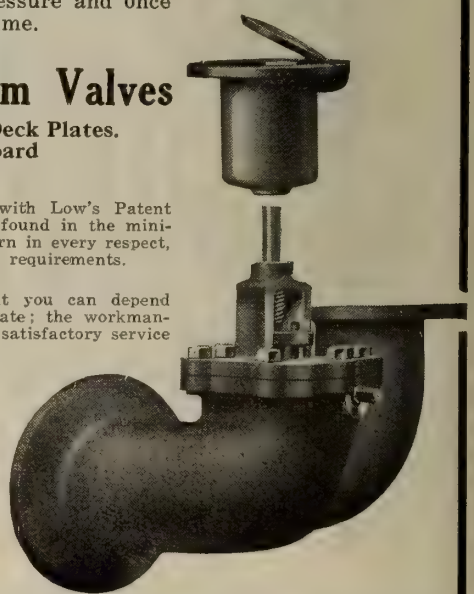

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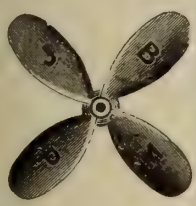

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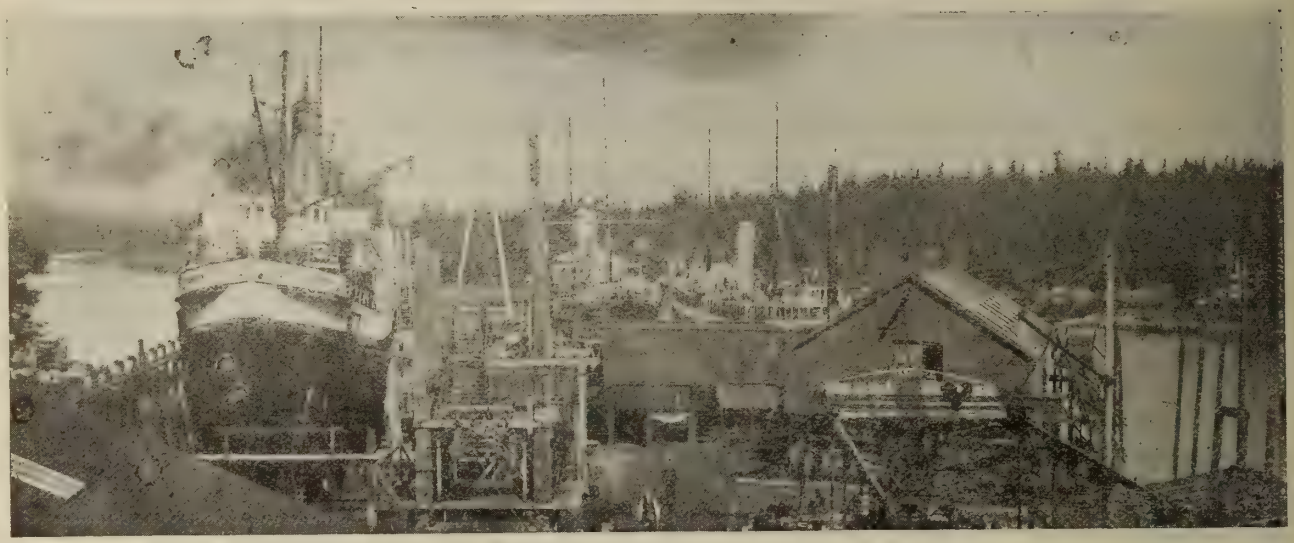

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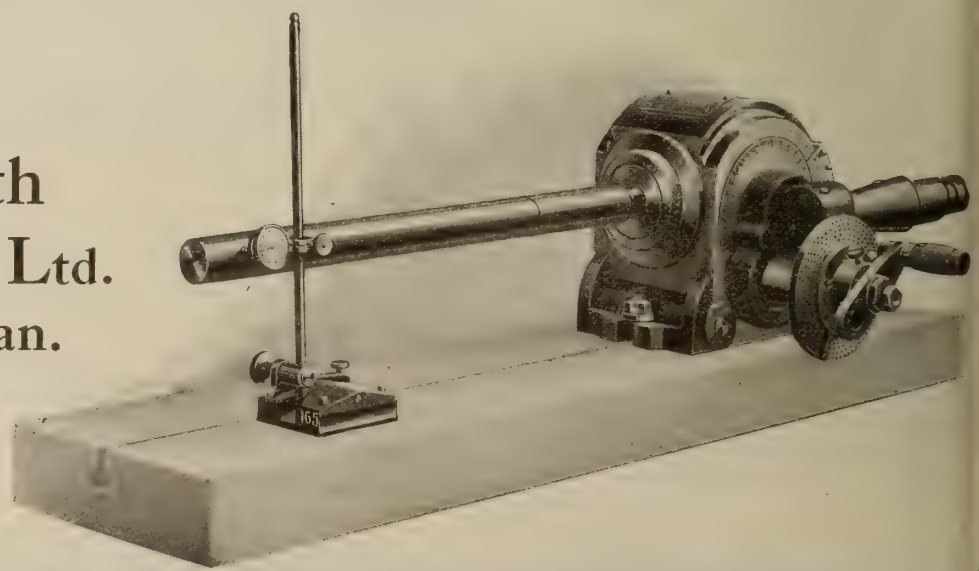

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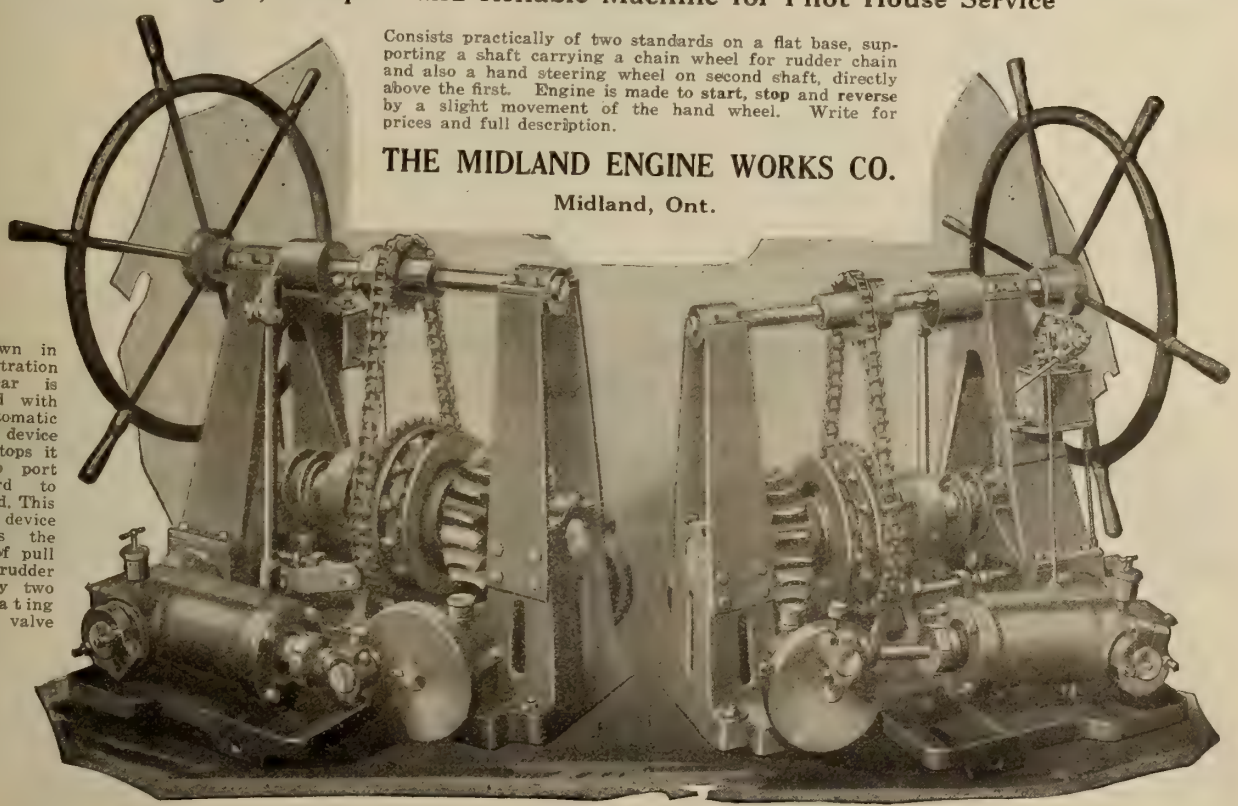

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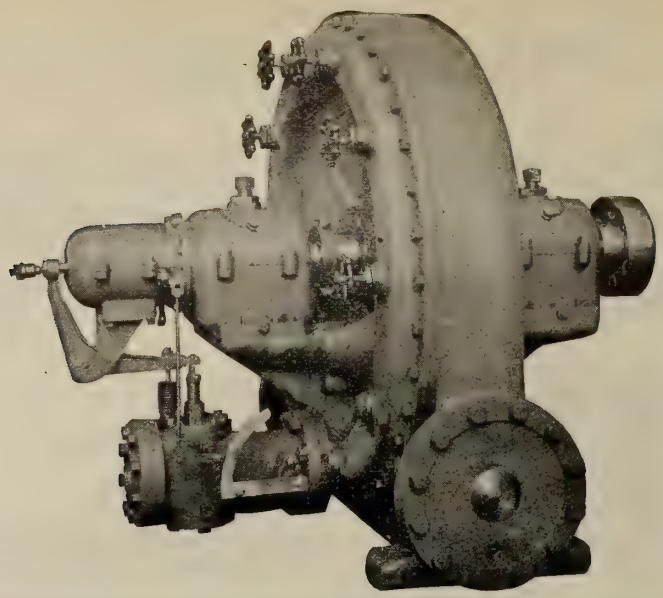

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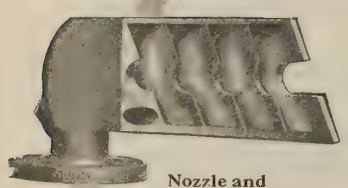

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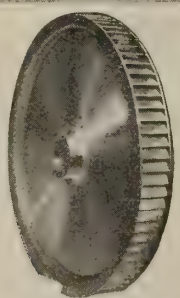

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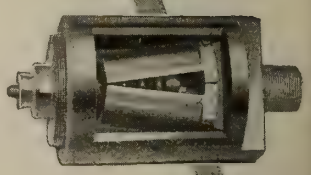

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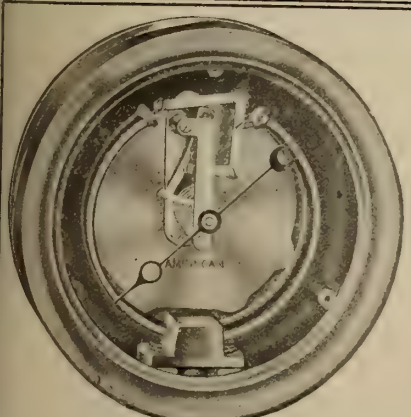

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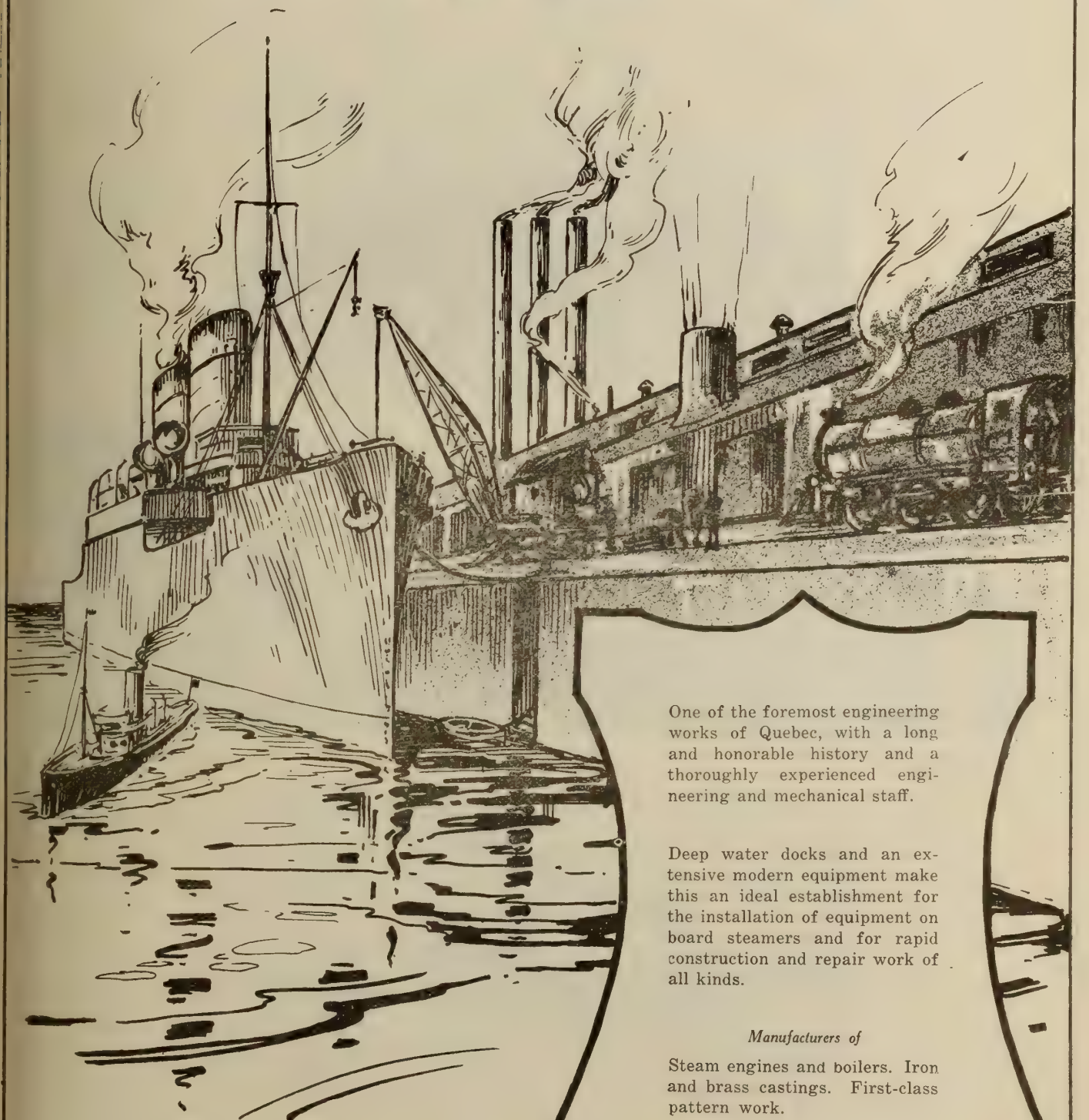

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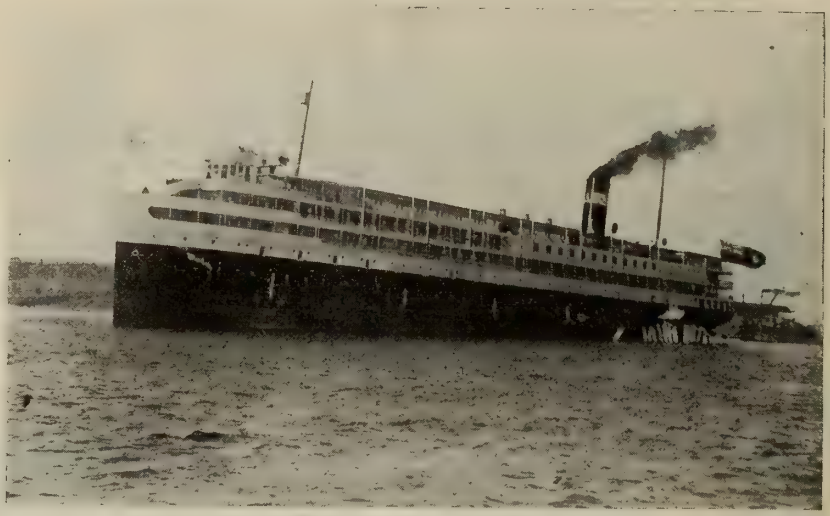

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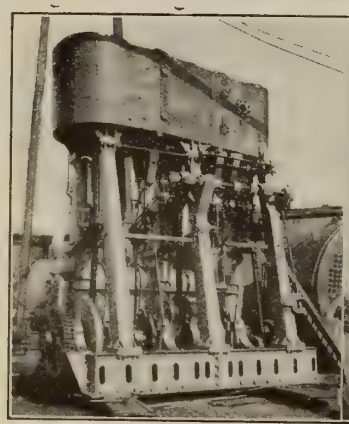

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MARINE ENGINEERING
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Canadian Merchant Service Guild Review

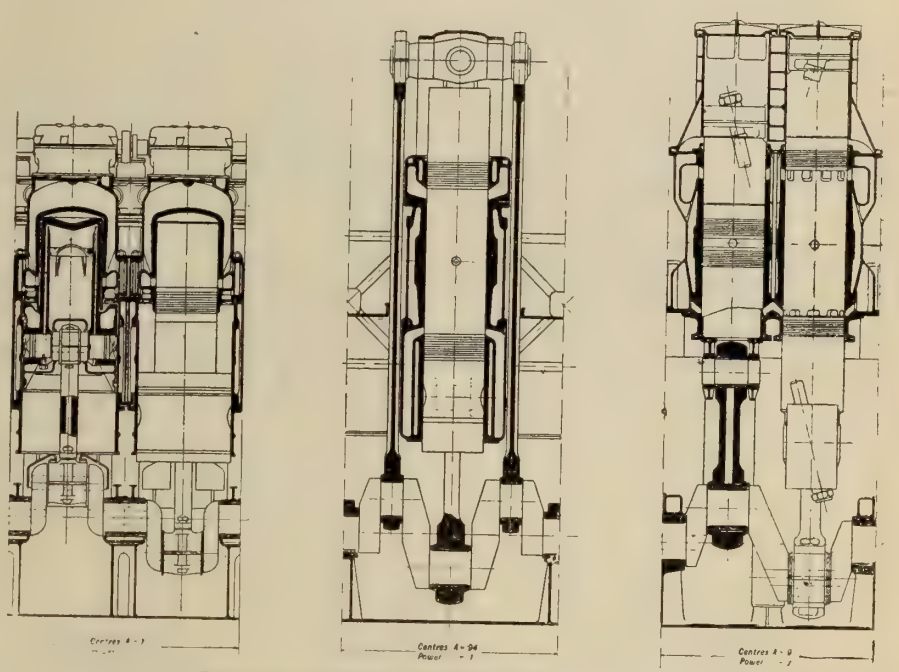
Vol. X. TORONTO, MARCH, 1920 No. 3

The Cammellaird-Fullagar Diesel Described

This Engine, Developed by the Firm of Cammell, Laird & Co., Birkenhead, England, Possesses Many Points of Interest. Four Pistons Drive Two Cranks and Much Space is Saved

DEVELOPMENT of the marine oil engine proceeds with great vigor in Great Britain. For some years the firm of Cammell, Laird & Co., Birkenhead, have been perfecting a design, and experimenting. A coasting steamer of 500 tons has been built, notable for the fact that her hull is entirely electric welded, no rivets being employed. The new engine will be fitted in this steamer, and performance under actual seagoing conditions can then be seen. The engine has been very widely commented on in the technical press of the United Kingdom, and the following description is from "The Engineer."

The underlying principle of the Oechelhauser gas engine is one that has always appealed to us as suggesting a line of progress for the marine Diesel engine of large power. But it has certain drawbacks, and any arrangement that will eliminate them must command our attention. The Oechelhauser principle we understand to be the use of a plain open-ended cylinder in which the combustion takes place in the centre of its length and between two pistons, which consequently move away from each other, and in so doing act as valves to uncover ports at each end of the cylinder for scavenge air and exhaust. The principle embodies three main advantages:—(1) The elimination of the cylinder cover, which under the ordinary conditions of temperature and pressure furnishes a very fruitful source of trouble; (2) The provision of a plain cylindrical liner, which eliminates risk of distortion due to uneven temperatures stresses, such as occur in a motor cylinder of the ordinary type with its varying thicknesses of metal; (3) The straight-through scavenge from end to end of the cylinder. It is probably unnecessary to speculate as to which of these characteristics is the more valuable as tending to secure the greatest reliability, nor need the advantage of having no valves for scavenge air or exhaust be pressed, as it is held in common with some two-cycle engines of the port-scavenging type. There is, however, a further important advantage which this arrangement of necessity brings about, namely, the perfect balance



RELATIVE SIZES OF THREE TYPES OF OIL ENGINES

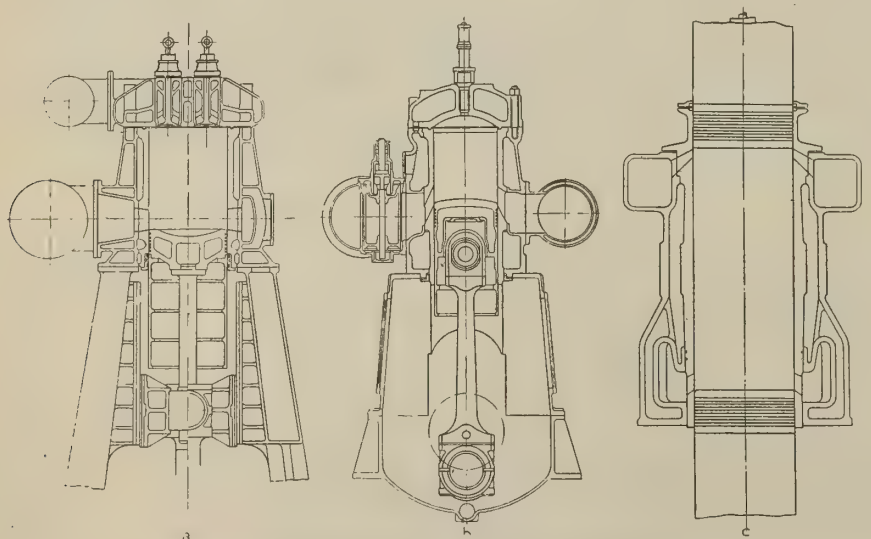
of the reciprocating parts provided by the opposed pistons, owing to the reciprocation of equal and opposite weights at the same speed. The best-known application of the opposed piston design, as we had better call it, as applied to marine work in this country, is that of Doxford & Sons, Ltd., of Sunderland. In the Doxford design the upper piston is attached to a crosshead on the top of the engine, from which descend two outside connecting-rods coupled to crank pins at 180 deg. to the central crank pins, to which the lower piston is directly connected. Thus there are three cranks and three connecting-rods for each cylinder, and as there is no bearing between the three cranks, a good deal of weight is expended in providing the necessary stiffness in the shaft. This multiplicity of cranks and connecting-rods is, it must be admitted, a somewhat roundabout method of obtaining the desired result, and it is there that the Cammellaird-Fullagar engine, which is now being developed for commercial marine use by Messrs. Cammell, Laird and Co., of Birkenhead ,suggests a promising solution.

In this engine two cylinders placed close together have to be adopted as a unit—as shown diagrammatically in Fig. 5. Each cylinder has its own crank, a single one only, and the upper piston A of one cylinder is connected by the lower piston B of the second cylinder by a diagonal rod, the upper piston C of the second cylinder being similarly connected to the lower piston D of the first cylinder. Thus, as the combustion takes place between the pistons A and D, D is pushed downwards and drives its crank round, the piston C, following through the action of the diagonal rod, while the piston A rises and draws the opposite piston B upwards. Thus, in place of a unit of one cylinder with two pistons, three connecting-rods and three cranks, we have a unit of two cylinders, with four pistons, but only two connecting rods and two cranks, and with the addition of four diagonal rods, the unit giving double the power with the same size of cylinder. As far as working parts are concerned, we have

one rod and one crank per cylinder, as against three rods and three cranks, and so far the advantages are obviously in favor of the Fullagar engine, apart from the question of balance, which we shall deal with later. The argument cannot, however, be concluded quite so simply, for there is the effect of the diagonal rods to be considered, which at first sight looks much more serious than it actually is. The only possible objection which we can see to these diagonal rods is one which is common to all Diesel engine work, and that is the need for very accurate work in machining the face of the slippers on the end of the piston to take the lateral thrust, in boring the diagonal holes in the crosshead to take the rods, and in getting the exact length of the rods; while from the point of view of design, it is essential that the guide should be stiff enough to resist the thrust. If these points are satisfactorily met — as, of course, they ought to be and can be — the drawbacks vanish, as the rods are always in tension, since when the piston A is rising, owing to the combustion pressure, the piston B is being pulled up against the compression pressure. It should be pointed out, too, that the thrust on the diagonal rod guides, is at a maximum almost instantaneously just at the peak of the indicator card, and when the pistons are at their inmost position and the shoes thrust against the stiffest part of the guide. It should also be said that the obliquity of the rods is less than the maximum obliquity of the connecting-rod proper, so that the friction is less than that of an ordinary connecting-rod in its guide.

unlooked-for result in that the combination gives two double-acting cylinders without any of the troubles which are to be anticipated with combustion taking place on both sides of the piston, and from the presence of glands exposed to high temperature. At the same time, since the cranks are at 180 deg., although there are two impulses on each crank per revolution, the engine is only the equivalent of a two-cylinder two-crank engine of ordinary two-cycle design or even a single-cylinder double-acting engine so far as turning moment is concerned, and the real advantage is in the reduction of the bending moments on the shaft, so that more power could be transmitted through a shaft of given diameter without any increase in stress. The comparative turning moments of a twelve-cylinder Fullagar engine and a twelve-cylinder four-cycle engine are shown in Fig. 6, and are worthy of study. The remarkably even turning moment of the former will be especially useful in that it enables the engine to run at a very low revolution speed—a fact which will be appreciated by "The Bridge" when handling the ship into port.

There is one point in which the greater number of parts in the Doxford engine gives some advantage over the Fullagar. With the two outer cranks drawn upwards by the pressure between the pistons and the central crank driven downwards with an exactly equal and opposite force, no load would be placed on the main bearings by the combustion pressure on the other. As a counterbalance, for what it is worth, at all events when all cylinders are working, nearly



COMPARISON OF SCAVENGING SYSTEMS

Having now brought out the main distinguishing points of the Fullagar engine we may proceed to deal with some of the "consequentials." In the first place, there is, of course, the opening of the scavenge and exhaust ports by the piston, and the resulting elimination of all valves for that purpose. This arrangement gives the beautifully clean run through for the scavenge air from one end to the other end of the cylinder inherent in the Oechelhauser principle. Then we have an all the negative work of compression between the pistons is performed by the diagonal rods, and not through the connecting-rods and crank shaft as is usual. Though this fact may be of little importance in itself, it has the effect of providing a cushioning effect at the end of the stroke in both directions, which should tend to make a sweet running engine, and reduce wear.

One other point remains to be dealt with, that of balance. It will be seen that by means of the diagonal rods, not only are the total reciprocating weights exactly equal in amount for the two directions of reciprocation, and therefore balanced, but the centre of gravity of these parts has the same locus on a line between the centres of the two cylinders,

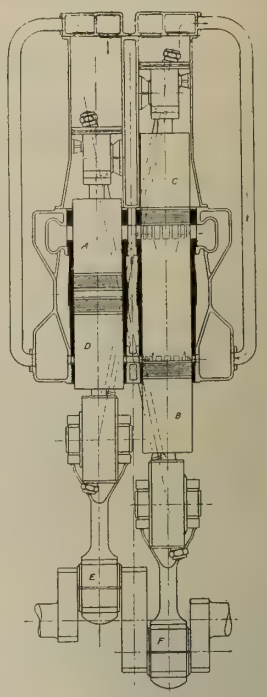
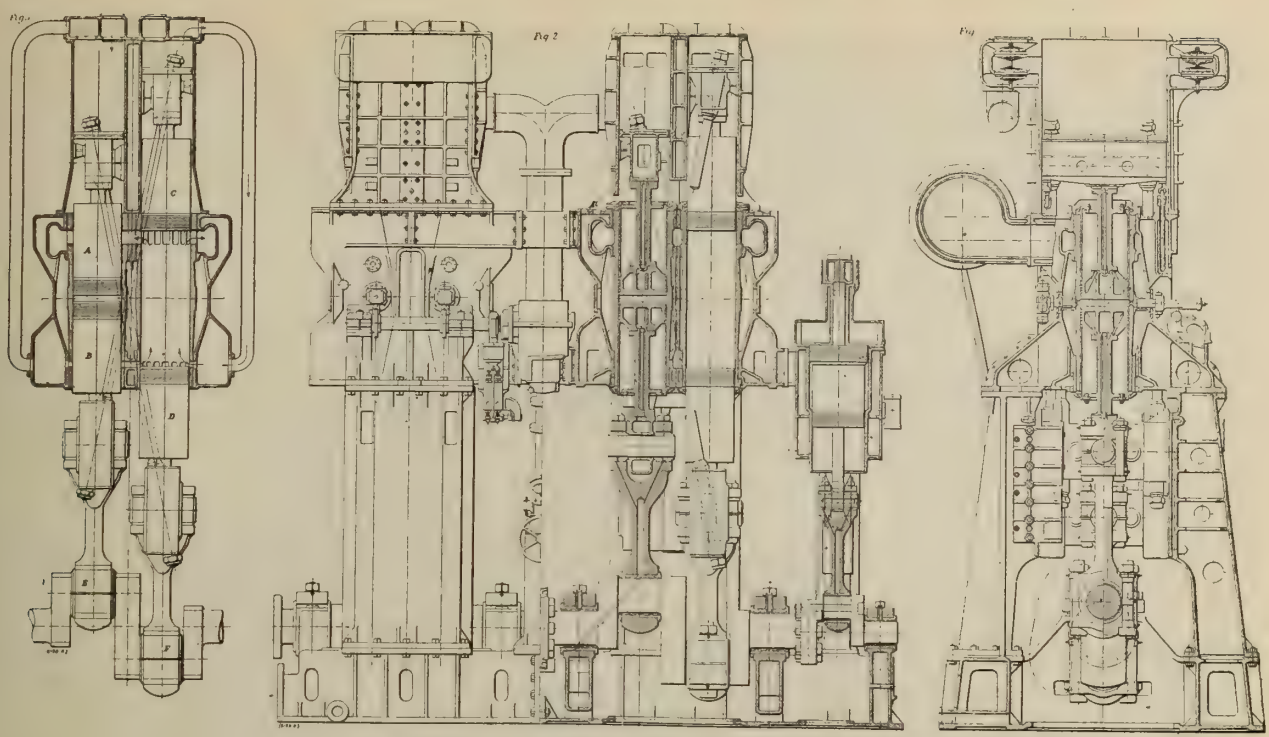


DIAGRAM OF CAMMELLAIRD FULLAGAR ENGINE

so that the couple is also eliminated, and only the angularity of the connecting-rod is left, which is of course, dealt with in an engine of two units.

Quite the most remarkable claim made by the builders of the Fullagar engine is as regards the saving in fore and aft space which it is possible to obtain with this engine as compared with other types. Their words are: "In comparison with the usual type of four-cycle marine engine, it is possible to put about 100 per cent. more power in the same space." In confirmation of this assertion, they have prepared the sketch reproduced in Fig. 8, which shows that an existing four-cycle marine engine of 1,550 indicated horse power occupies a length of 43 feet 9 inches, as against the 22 feet 9 inches required for the Cammellaird-Fullagar engine of the same power. Figs. 1 to 3 put the proposition in another way, and include the two-cycle engine in three forms. Fig. 1 shows the shortest space into which two stepped-pistons of ordinary two-cycle design could be got in for a power assessed at unity and the bearing lengths and centres arrived at by proper allowances for strength and surface alone. The stepped piston is a very fair example to take, as it includes the scavenge pump, as also does Fig. 3, which represents a four-piston unit of the new design, while Fig. 2 shows a two-piston engine of the opposed piston design which makes no allowance for the scavenge pump. On this basis it will be seen that on a given length the Cammellaird-Fullagar engine gives 2.2 times the power of the stepped-piston two-

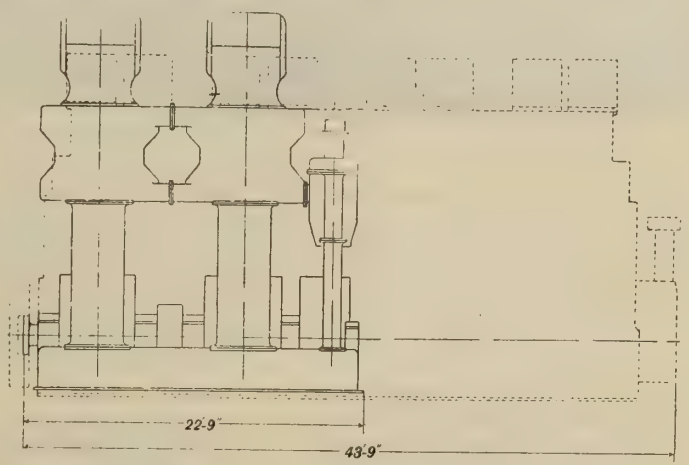


1,000 B. H. P. 2 UNIT—FULLAGAR ENGINE

cycle design. We may say that in view of the wide divergencies in mean effective pressure, piston speeds, scavenge air pressures, etc., in different Diesel engines, we could only accept these figures as applying to the particular engines which may have been used for the calculations, and this point is largely conceded by builders in the very ample notes with which they have kindly accompanied their drawings.

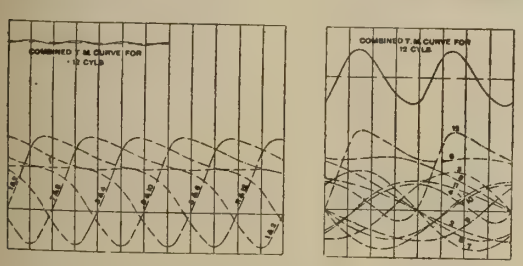
Another form in which the same idea is worded is that a Cammellaird-Fullagar engine with 20-in. diameter cylinders will give the same power as a four-cycle engine with the same number of cylinders, of 30-in. diameter, running at the same speed, or that if the 30-in. four-cycle engine develops 2,800 brake horse-power in eight cylinders, an eight-cylinder Fullagar engine with 30-in. cylinders would give 8,400 brake horse-power.

If it is found in practice, as we have no reason to doubt it will be, that these figures are realized, the saving in weight and first cost will be very considerable, the builders claiming between 25 and 50 per cent. under the former heading, depending on the conditions, but without any attempt at weight cutting. This, too, in spite of the fact that the revolution speed is reduced, as the opposed piston arrangement doubles the mean rate of expansion of the burning charge. The 500 brake horse-power engine which has completed its bench trials, for instance, runs at 120 revolutions per minute, which gives a piston speed of only 400 ft. per minute, and we are informed that a 3,000 indicated horse-power engine would only be run at about 75 revolutions per minute. In addition to weight and space saving, there ought therefore to be increased economy in fuel, owing to the higher efficiency of the propeller at such a low speed, together with greatly reduced maintenance charges, owing to reduced wear and tear and the fact that there is only one valve per cylinder working.

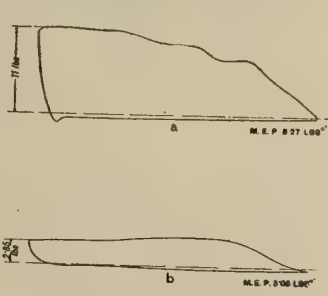


COMPARISON BETWEEN FULLAGAR AND FOUR-CYCLE ENGINE OF SAME POWER

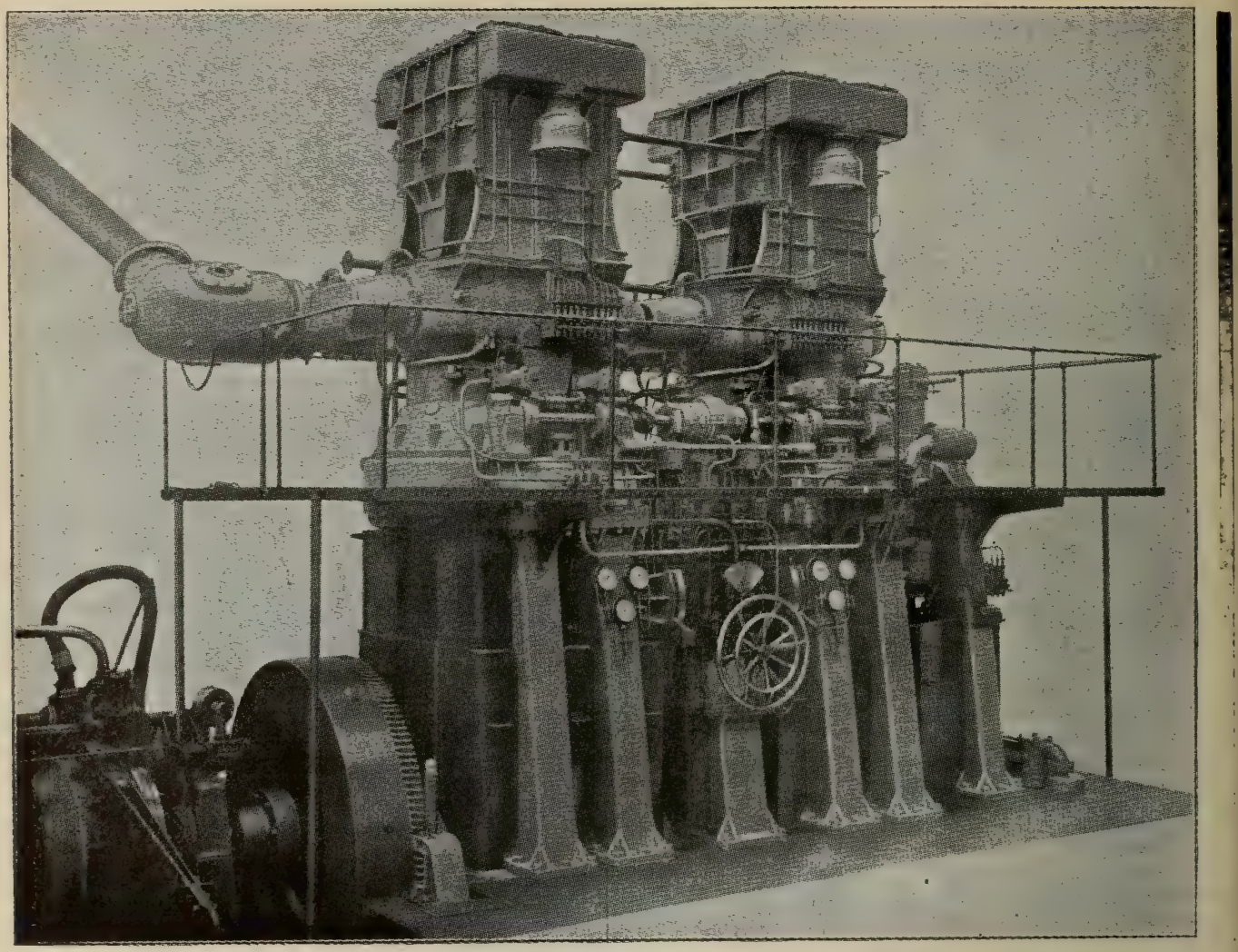
Another point put forward by the builders is that not only is the cylinder liner relieved of longitudinal stresses, but the framing also, which has therefore only to carry the weights and provides stiffness against the lateral thrust of the connecting-rods and the fore and aft thrust of the diagonal rods, and this fact must be taken into consideration in connection with the claims for weight saving. The effect of the opposed piston arrangement goes still further and reduces the load on the main bearings by an amount which the builders put at 30 per cent., but which we should have thought would be greater. The fact that there are only two bearings for each pair of cranks makes for a further saving, both in weight and manufacturing



TURNING MOVEMENT OF FULLAGAR AND FOUR-CYCLE ENGINES



INDICATOR DIAGRAMS

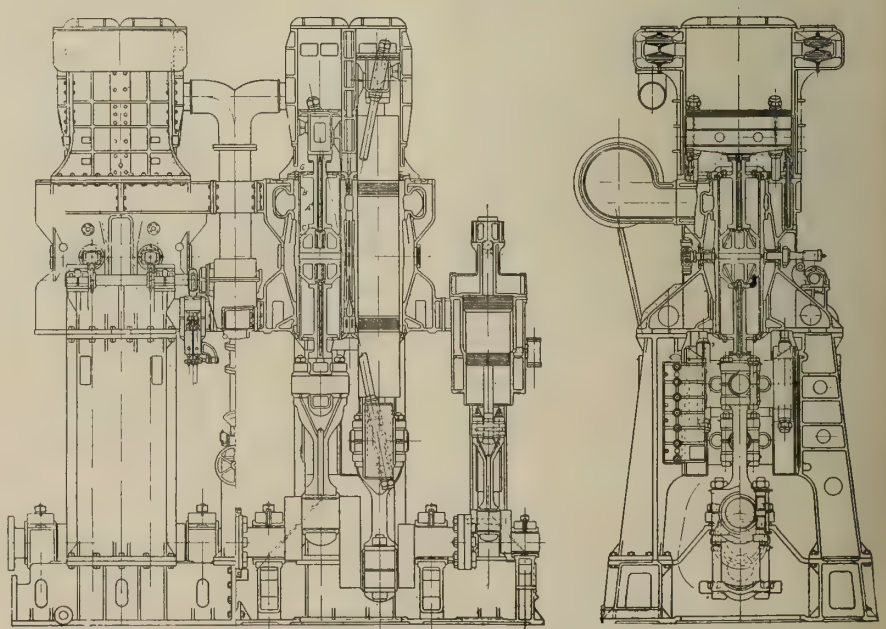


GENERAL VIEW OF ENGINE

costs, though time will be required to show whether it will have any adverse effect on the life of the crank shaft, but as the loads on the bearings are reversible efficient lubrication can be ensured.

There is one very remarkable statement in the builders' notes to the effect that the 1,000 brake horse-power engine, which is now under construction in their works, while actually giving 150 more brake horse-power, takes up 16 per cent. less room fore and aft than a three-cylinder 850 brake horse-power two-cycle double-acting engine which is fitted in a German-built ship just handed over to British ship-owners as part of the war replacement, and of which full and authenticated particulars can therefore be obtained. We must admit to being ourselves of those who thought that the solution of the big Diesel marine engine lay with the double-acting principle, and this definite evidence comes therefore as rather a surprise. We still have doubts, however, whether the comparison would come out with the same result if both engines were of really large power, much though we should like to see it substantiated for the prestige of British engineering.

The builders, in the particulars they have given us, deal at considerably greater length than we have done in our own notes with the general question of scavenging, more particularly with its application to the Fullagar engine, and we think that a *resume* of their remarks is worthy of publication. Any excess of scavenge air is pure waste, first, through the work performed by the pump in uselessly compressing it, and, secondly, through the harmful effect which it may have upon the combustion. The description deals with the pros and cons of the three systems of scavenging for two-



1,000 B. H. P. TWO-UNIT CAMMELLAIRD FULLAGAR ENGINE

cycle engines, namely, valves in the head, ports and valves, and ports only as in the Fullagar—see Fig 4. The first-named, it is noted, gives a good sweep through from end to end, but calls for the addition of moving parts, the valves, and for a higher pressure, in order to overcome the resistance of the restricted port areas, while there may be parts left in the cylinder which are not reached and cleaned out by the fresh air current. The second plan is roundly condemned on the ground that owing to the receiver space between the piston and the valve acting as a receptacle for exhaust gases between the time the port is opened by the piston and the opening of the valve, the incoming air will be diluted and the cylinder consequently scavenged to begin with by impure air, and that generally a large quantity of air beyond that necessary for combustion or complete scavenge is required. The Fullagar plan is naturally claimed to be the best, as there is a complete ring of ports round the cylinder and no valves, so that a low pressure of air can be used, and little more in volume than that of the cylinder itself, to effect a complete clearance of the burnt gases and leave a pure charge behind. At the same time the complete ring of exhaust ports round the cylinder allows their length to be kept short and the effective working stroke to be kept to a maximum. The consequence is that this engine can work with as low as 1½ lb. per square inch air pressure, and that the pumps do not absorb more than 4 per cent. of the power of the engine, so that a high mechanical efficiency ought to result. The diagrams shown in Fig. 7 would seem to bear out this claim, *a* is from a valve scavenging engine, and *b* from a Fullagar engine, and from them it will be seen that the work done by the former is far in excess of that done by the latter. It is, however, admitted in the builders' notes that the scavenging of a four-cycle engine is more efficient than that of the two-cycle engine, though whether this admission applies to the Fullagar engine too we are not able to gather.

LAUNCHING OF STEAMER FROM ARMSTRONG YARD

Sir W. G. Armstrong, Whitworth & Company, Ltd., launched to-day from their Armstrong Shipyard, the twin-screw cargo steamer "Tairoa" which was built to the order of the Shaw, Savill & Albion Company, Ltd.

This vessel is of the two-deck and shelter-deck type, and has been built to the requirement of Lloyd's Registry. She is insulated throughout for the carriage of frozen and chilled meat. Special attention has been paid in the design to the rapid and economical handling of cargo, each hold being provided with numerous derricks and winches for this purpose, there being eighteen winches in all.

The principal dimensions of the vessel are:

Length, between perpendiculars	477' 0"
Breadth moulded	62' 9"
Depth moulded to upper deck	34' 4"
Depth moulded to shelter deck	42' 4"
D. W. on loaded draft of 28' 9", Tons	11,000

The hull is divided into nine watertight compartments, by means of eight transverse watertight bulkheads. Water ballast is carried in the afterpeak and the double bottom extends the full length of the vessel between this tank and the forepeak bulkhead.

The propelling machinery consists of two sets of quadruple expansion engines, having cylinders 23" x 32" x 45" x 65", with a stroke of 48". Steam at 220 lbs. pressure is supplied from five boilers 15' 4½" diameter, and 12' 4" long. These boilers are fitted with Howden's forced draft system. The propellers are four-bladed and manufactured of bronze. The designed horse power for the machinery is 5,000, which gives a speed of about 13 knots.

The steering gear is of the Wilson-Pirrie type, housed in the shelter deck aft, and is controlled by telemotor from the navigating bridge.

In addition to the usual auxiliaries, the vessel is fitted with a Marconi Wireless installation.

The deck-officers are housed in the midship deck-house, the engineers and refrigerating engineers on the bridge deck alongside the engine-room casing, and the seamen and firemen in the forecastle.

This launch marks an epoch in the history of the Armstrong Naval Yard, as under the great commercial reconstruction policy laid down by Armstrong's. She is the first mercantile vessel to be launched from this yard, which was originally designed and laid out entirely for warship building.

The foresight and energy of Armstrong's is clearly shown by the fact that in addition to the "Tairoa," the Naval Yard is at the present time fully occupied in the construction of many other types and sizes of mercantile vessels.

RECORD OUTPUT OF BRITISH SHIPBUILDING

The report of Lloyd's Register for 1919 shows a most encouraging expansion in the output of British shipbuilding yards. At the beginning of the year close upon 2,000,000 tons were under construction in the United Kingdom. By the end of March there was an increase of 275,000 tons; at the end of June, 269,000 tons; and at the end of September, 293,000 tons. When the end of the year was reached, the total had risen to the enormous figure of close on 3,000,000 tons, so that the tonnage under construction at the beginning of 1920 was over 1,000,000 tons in advance of the figure for a year earlier. The record figure before the war was just over 2,000,000 tons in March, 1913. There are now under construction no less than 55 vessels of over 10,000 tons, and 22 of these are of 15,000 tons and over. The largest oil-engined British vessel launched during 1919 was of 6,980 tons.

SWEDISH FIRM HAS BIG PROGRAM

The Transatlantic Shipping Company of Gothenburg, one of our largest transoceanic shipping companies, has for some time been elaborating a program for new building which aims at making its fleet the largest and best equipped in Scandinavia. For this purpose the company has successively sold most of its vessels under 4,000 tons, and has ordered in their place new and up-to-[illegible] During the years 1920-1921 Swedish and British shipyards are to deliver 73,600 tons deadweight, after which the total tonnage of the Transatlantic Company will amount to about 265,000 tons deadweight. Of the new vessels 45,000 tons are to be motor vessels of the Diesel type or oil-burners.

REDUCING LOST POWER ON HIGH SPEED VESSELS

While travelling on board a merchant vessel which was dodging German cruisers during the early days of the war, Dr. A. P. Thurston, a British scientist, carried out some interesting experiments on the distribution of wind pressure and velocity around the ship's funnel. The results of these experiments, which have just been published, show some curious arrangements of suction and pressure according to the direction of the wind in relation to the course of the vessel. One fact brought out is that quite a considerable amount of horse-power must be lost in driving the dead surface of a vessel against a head wind. Dr. Thurston therefore suggests that experiments should be repeated over the whole of the upper structure of a vessel so as to reveal those portions which present the largest amount of head resistance. This information would, he maintains, be most useful in designing high speed vessels and would enable the efficiency of designs to be improved without sacrificing the comfort or safety of the vessel. In destroyers and cruisers the wind resistance of the superstructure is a very important factor.

CANADIAN VICKERS ACTIVITIES

The big yard of Canadian Vickers Ltd., is well supplied with work for the coming spring which will keep their four berths busy.

During the winter they have been engaged on the following vessels: two 8,300 ton deadweight steamers for Norwegian owners, to be called the "Tatjana," and "Loch Tay;" two other steamers of 8,350 tons deadweight each for the Canadian Government Merchant Marine, the "Canadian Victor," and "Canadian Conqueror."

These four vessels will be launched about the opening of navigation, and work will be commenced on four further steamers. Two of these will be for the Canadian Government, the "Canadian Commander," and "Canadian Leader." The other two are for the Norwegian-American Line, and will be of 6,350 tons deadweight each.

The General Survey of Engines and Boilers

This Article Deals in a Descriptive Manner With the Work Necessary to Put a Ship's Engine Through Lloyd's or Board of Trade Survey

By T. H. FENNER

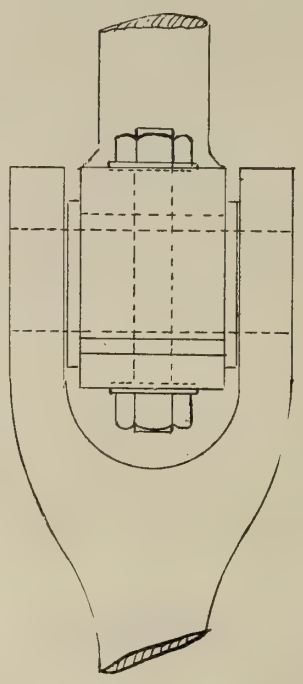
WE SAW in the previous instalment how to go about examining the crank pin, and adjusting the bottom end brasses. We will now discuss the taking down of the crosshead. It would perhaps have been more in order to discuss the crosshead first, but as far as the actual taking down is concerned, it does not matter. There are two methods of adjusting a crosshead, one of them making it necessary for the bottom end of the rod being free, the other way not requiring this. The first method is called swinging the rod. If it is the intention to set the rod this way, the proper procedure would be to take the top end, or crosshead brasses down before touching the bottom end, or crank pin brasses. After examining the pin, the brasses would be put back in place, without any fine adjustment, and the crank pin overhauled. Then before the crank pin brasses are connected up again, the rod would be swung and adjusted. We will describe this later.

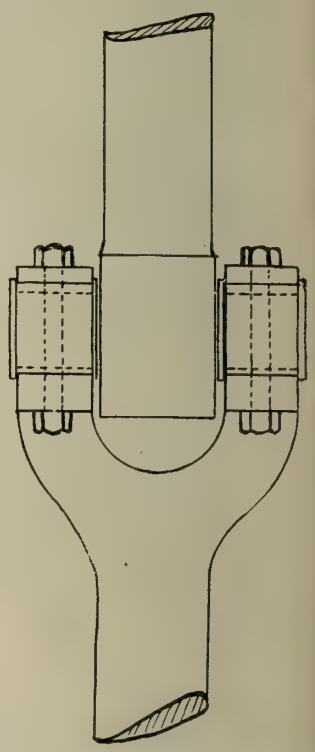
Taking Down the Crosshead

The engine is of course hung up in the manner described in the previous article. The procedure will vary somewhat depending on whether the rod is of the fork end type, with a bearing on each side of the crosshead, or the type in which the gudgeon is a part of the rod and there is only one bearing. The fork end type of rod, with the gudgeons carried by the crosshead and a bearing on each side, is somewhat easier to handle than the other type, but there is not a vast amount of difference. The only special requisite is to know how you are going to do the job, and have whatever gear is necessary ready to use. I have seen a third engineer, fireman, and the top half of a top end brass all land in the crank pit, to their mutual discomfort and material damage, through trying to dispense with a necessary piece of tackle, to *save time*.

We will consider first the rod end with gudgeon pin and single bearing. We have said that the engine is hung up. With this type of crosshead bearing it is much more convenient to have the crank on the bottom centre until the cap and lower brass have been taken down. The crank is then turned up to the top for the purpose of hanging up and taking the rod down. However, as we have already got the engine hung up, we can go ahead in the position it is in, without wasting time to turn the engine.

As in the taking down of the crank pin, the first thing is to mark the nuts. The safety set screws in the collars are slacked, and the nuts slacked back. The crosshead spanner is usually made in ring form, with two lugs, or perhaps one for striking purposes. It is heavy to hold, so as soon as the initial tension is relieved, a skeleton spanner of the star type is brought into play. Before slackening down the nuts altogether, when there are still two or three threads on the bolts, a block of wood is put under the cap for it to come down on. The men then take their positions, one behind and one in front of the rod, and take the weight of the cap and brass between them. The block of wood is withdrawn, and the cap and brass lowered onto the fork of the rod, being still guided by the bolts. The front bolt is then lifted up till it clears the lower brass as it rests on the cap. It is either





blocked up in this position or lifted clear of the crosshead altogether. The latter is really the safer way of doing it. The brass is then pulled out to the front, and passed down to the platform. The cap being much heavier, must be handled by the block and tackle. The back bolt is raised clear of the cap, and the cap shoved forward, the sling being placed through the front bolt hole. The cap is landed on the starting platform out of the way, and everything is ready to go ahead with the top half of the brass. It is best to take the crosshead bolts out of the way, but if there is not clearance enough to withdraw them, they can be blocked up clear.

The next step, after observing the usual precaution of seeing the propeller is clear, is to station a man at the turning engine. Now, according as the crank is turned in the ahead of astern direction, as the rod goes down it will lean over to the front or back of the crosshead, and as it comes clear will unless checked, fall over violently against the guide. Now some men use a plank to guide the end of the rod down on, but the writer prefers to guide the rod end with a couple of pair of light blocks. These are fastened to the front or back columns, and can be used to keep the rod end central in the crosshead, as it comes down. This in turn makes it easier to handle the top brass. Sometimes the brass will stick on the crosshead. If it does, start it down with a block of wood and the hand hammer, so that it follows the gudgeon as it moves down. If you go on turning down and watching the rod, leaving the brass in its place, it is very liable to suddenly drop, strike the pin, slide round and land in the crank pit before you know what's happened. If you prefer to leave the brass sticking in the crosshead while you turn the rod down, make it fast with a turn or two of marlin or spring arm. Personally, I prefer to have the brass come down on top of the pin, when it can be guided easily by hand, the opposing tackles keeping the rod in the centre of the crosshead gap. When the rod has been turned down sufficiently to

reach the brass and get a good hold of it, all attention can be given to lifting the brass down, the rod being handled by the tackles. Once the top brass is handled safely, the engine can be turned down till the end of the rod comes clear of the crosshead. Then, place a suitable block of wood on the guide face, ease the rod against it, and leave it there to examine at your leisure. The only difference in handling the rod fitted with two bearings, is that the bearings being outside, are easier to get at, and more convenient all round than the first type described. The bearings, as there are two of them, are lighter by far than the single bearing type.

There are some points to observe, in taking down these bearings. For instance, the bolts are put in from the bottom up, and when the nuts are slacked off, there is nothing to hold them in place but the fit. This may be tight or otherwise. Therefore, it is a wise precaution to go easy when slackening off the nuts. The simplest way is to fasten the rod up to begin with, by means of the two opposing tackles and make fast. Then take the nuts off, and the bolts out completely. Lift the top half of the braces off, and put it in a safe place. Do this with both bearings. Then the crank can be turned down just far enough to slide the lower halves out round the pin. This can be helped by pulling the rod over a little to give clearance. It is as well to have a man on each side of the rod and one to work the tackle; while this is being done. Once the brasses are off, the rod can be eased over onto the guide as in the first case.

It may seem to some readers that these are unimportant details to write about. Details are never unimportant. I have seen a high pressure gland smashed to pieces, while the whole engineering staff was in the engine-room. This was due to a carelessness for detail. The gland was down for packing, resting on the crosshead. The third who was working on the air pump links, wanted to turn the engine. He sent the fourth who was working at a valve on the boiler front, to see if all was clear aft. When the fourth came back, the third got him to watch one link, while he watched the other, and the second went to the turning engine. All went merrily until a loud crack was heard. Everybody jumped, the turning engine was hurriedly stopped, and an investigation instituted. The gland was found broken in three pieces, the reason being that as the H. P. engine went up, the gland came up against the studs, and the holes being out of line, the crosshead pushed from below, the studs resisted from above, and the gland not being strong enough to stop the engine, collapsed. Can you realise how much work that put those fellows to? Can you imagine the eloquent way the chief expressed his opinion of the second, third and fourth? Lastly, can you realise the feelings of the superintendent engineer in the home office as he reads the chief's report, "Owing to an absolutely inexplicable lack of attention on the part of Mr. Second particularly, and Mr. Third and Fourth in slightly less degree, the high pressure piston rod gland was broken in three places, causing the ship to be delayed twelve hours."

How many turning gears have been stripped through not being disconnected when overhauling was finished? Every sea-going engineer has heard of cases. The object of these articles is not to teach the experienced engineer his business, but to give the younger ones an idea of how the jobs are done, perhaps before they ever see them. The next article will deal with putting back and adjusting the crosshead bearing.

ANNOUNCEMENT

MR. F. A. COMBE, known to many readers in his former capacity of chief engineer for Canada to Babcock and Wilcox, Ltd., has severed his connection with this company, and is practising as consulting combustion and steam plant engineer with offices in the Southam Building, Montreal.

MR. F. A. COMBE.

Mr. Combe's special study of problems relating to the boiler-room and his realization of the need for co-operation with operating engineers and management have determined his decision to devote his whole time to this work.

Mr. Combe was born in 1882 at Gorlestone, England, was educated at Framlingham, College; Bedford and Manchester Technical Schools, and served five years apprenticeship in the shops and drawing office of W. H. Allen, Son and Co., Ltd., Bedford. Following this training, he spent two years with the British Westinghouse Electric and Manufacturing Company on gas engine, erection test and outside trouble work in England, Spain and France, later returning to Messrs. Allen as chief assistant in the testing department.

Coming to Canada in 1907, he was associated for three years with various consulting engineers, having charge of the operation and remodelling of the Central Heat, Light and Power Company's plant, Montreal; Vancouver General Hospital, etc., with Messrs. Ross and Holgate; and of design and construction of the McGill University Power House, distribution systems, heating and ventilating of the McGill University Medical Building with Prof. R. J. Durley.

Since 1910, Mr. Combe has been with Messrs. Babcock and Wilcox, Ltd., during which time he has been closely connected with the majority of the large plants in Canada. Mr. Combe is a member of the Engineering Institute of Canada and also of the American Society of Mechanical Engineers.

During the military operations on the Salonika front it was necessary to construct a bridge across the Selimb River. The work required the driving of forty-eight piles about 40 ft. long and 12 in. square to a depth of 24 ft. in gravel, clay, and quicksand. A pile driver with 30 ft. leads and a 1,200 lb. top was employed and a 4-ton motor lorry used to raise the weight. The lorry was set up on the bank, the left-hand rear wheel was jacked up and blocked 10 in. from the ground, and the other three wheels were snubbed and staked to the ground. The lead rope was given a turn on the brake drum inside the wheel, one man operating the loose end. The distribution of labor was as follows: One motor driver, one signalman, one on the lead rope, three on the pile driver, and two sharpening and putting on pile rings. Work was continuous in three eight-hour shifts, and the bridge was completed for traffic in twelve days.

A new form conveyor is being used with considerable success in the Denaby Main Colliery. From a description in the "Iron and Coal Trades Review" it appears that the conveyor troughs are suspended by chains from cross bearers fixed between the pit props. Another cross bar is arranged below the bearer in such a manner that the chain may swing through an arc of a circle with a radius of the full length of the chain on one side of the vertical, while the curvature of the arc on the opposite side of the vertical is much more pronounced. The troughs are reciprocated by a compressed air motor and the coal is propelled in the direction of the short arc. A conveyor of this type 300 yards long by 22 in. wide can deliver a ton of coal every minute.

A seam of good quality coal is said to have been discovered near Cape Horna, in New Guinea. The coal contains from 2.7 to 4 per cent. of ash and has a calorific value of from 7,550 to 7,875 B.t.u.

New Developments in High Vacuum Apparatus

In a Paper Read Before the Society of Naval Architects and Marine Engineers, in New York, the Author Points Out Some Features of This Equipment

By G. L. E. KOTHNY

THE adoption of the steam turbine for marine propulsion has brought about many changes in marine engineering, which have become necessary in order fully to realize the many economical advantages obtainable. These changes affected particularly the vacuum-producing apparatus. Steam turbines require the highest possible vacuum for highest efficiency and economy. The importance of this has been realized, and considerable research work has been carried out and many developments have been made in relation to the condensation of steam and the extraction of air. The principles of surface condenser design have been dealt with in several papers to various societies during the last few years, many of which have shown a thorough knowledge of the physical laws and practical considerations governing the subject. However, very little has been said in these papers about the design and development of the air pump, which is the most important part of a vacuum-producing apparatus. It is intended in the following to record some developments which have been made during the last few years in the extraction of air from marine condensers.

The recognized limits of vacuum for well-designed marine turbine surface condensers based upon the inlet temperature of the circulating water are as follows:

1½ in. Hg. absolute with sea water at 60 deg. F.

2 in. Hg. absolute with sea water at 70 deg. F.

2.4 in. Hg. absolute with sea water at 80 deg. F.

2.75 in. Hg. absolute with sea water at 85 deg. F.

When estimating the correct size of air pump to use, the chief factor to bear in mind is the normal air leakage which the pump must handle. No definite rule can be laid down for the amount of air leakage, as it depends on the size and character of the installaion. In small installations this is relatively higher than in large ones. Also in condenser installations where a large number of auxiliaries, particularly those located on deck, are exhausted into the main condenser, the air leakage is greater than in a normal installation, and a larger air pump will be required. Extensive investigations have shown that the normal air leakage for marine surface condenser installations can be limited to the amount shown in Fig. 1, provided that any auxiliaries exhausting into the main condenser do so at a pressure slightly above atmosphere. The curve illustrated in Fig. 1 is based on the total amount of steam which the condenser receives. It also includes the air contained in the exhaust steam. The air received from the condenser is always fully saturated with vapor, the amount of which depends upon the temperature and absolute pressure. The relations between water vapor and air at different absolute pressures and temperatures based on Dalton's Law are illustrated in Fig. 2. In determining the air-handling capacity of the pump, the amount of vapor should be deducted from these curves and added to the normal air leakage given in Fig. 1.

In looking over Fig. 2 it will be seen that at a constant absolute pressure the amount of vapor decreases with the drop in temperature. It is therefore desirable to remove the mixture at the lowest possible temperature in order to decrease the size of air pump. This fact has been recognized and has led to the adoption of the dry system in which the air and the condensate are removed separately. The dry system permits the removal of the air and vapors at the lowest possible temperature by a dry air pump; the condensate is taken away at a higher temperature by either a turbine-driven or reciprocating condensate pump. Since the adoption of the dry system many developments have been made in dry air pumps, the most notable being the steam air ejector, which, due to its many advantages, has been extensively used during the last three years.

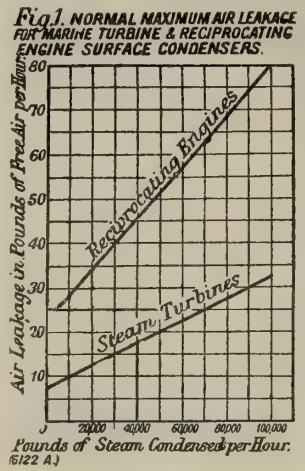

Air Leakage in Pounds of Free Air per Hour
Reciprocating Engines
Steam Turbines
Pounds of Steam Condensed per Hour.
(6122 A.)

Fig. 1. NORMAL MAXIMUM AIR LEAKAGE FOR MARINE TURBINE & RECIPROCATING ENGINE SURFACE CONDENSERS.

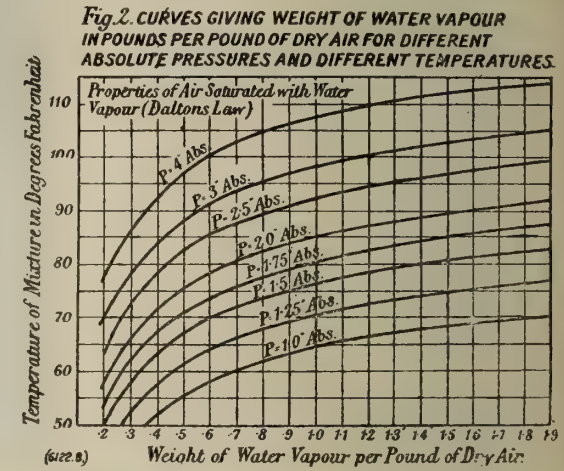

Temperature of Mixture in Degrees Fahrenheit
Properties of Air Saturated with Water Vapour (Daltons Law)
P. 4 Abs.
P. 3 Abs.
P. 2.5 Abs.
P. 2.0 Abs.
P. 1.75 Abs.
P. 1.5 Abs.
P. 1.25 Abs.
P. 1.0 Abs.
(6122.B.)
Weight of Water Vapour per Pound of Dry Air

Fig. 2. CURVES GIVING WEIGHT OF WATER VAPOUR IN POUNDS PER POUND OF DRY AIR FOR DIFFERENT ABSOLUTE PRESSURES AND DIFFERENT TEMPERATURES.

FIGURES 1 AND 2

The use of steam jets for the removal of air has been known for over fifty years. As early as 1868 a patent was granted for a steam-jet air pump. But this type of pump has never been developed to produce high vacua commercially until recently. This was due to the lack of the correct knowledge of the properties of steam and the want of interest in high vacuum. During the years 1900 to 1910 the properties of steam have been more accurately determined by several prominent scientists who made it possible to carry out experiments for the improvement of steam air ejectors. At the same time the demand for high vacuum became more pronounced, due to the adoption of the steam turbine.

The steam air ejector is a compressor in which the air to be compressed is entrained by one or more steam jets, which move through the entrainment space at a very high velocity. The entrainment is made by friction. The kinetic energy, originating from the steam jets, and contained in the mixture of air and steam after entrainment, is transformed into pressure in a channel called the diffuser.

Referring to Fig. 3, air enters through opening A into the entrainment chamber E; live steam expands through one or more nozzles whereby its static energy, due to its pressure, is transformed into kinetic energy. This transformation causes the steam to leave the nozzle with a velocity ranging from 3,000 ft. to 4,000 ft. per second. The steam jets J, while passing through the entrainment chamber E, entrain the air and give up part of their kinetic energy to the same. The outlets of the nozzle or nozzles are arranged opposite the opening of the diffuser D, and the mixture of steam and air enters the diffuser at a somewhat lower velocity than that of the steam jets leaving the nozzles. The mixture is gradually brought practically to a rest in the diffuser D, thus increasing its static pressure to or slightly above atmosphere. The efficiency of a steam air ejector depends upon the magnitudes of three losses:

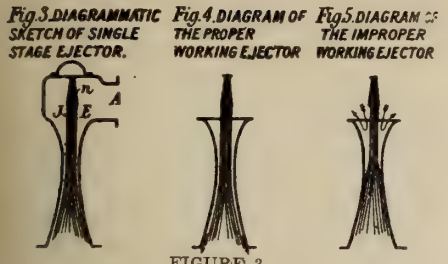


Fig.3.DIAGRAMMATIC SKETCH OF SINGLE STAGE EJECTOR.
Fig.4.DIAGRAM OF THE PROPER WORKING EJECTOR
Fig.5.DIAGRAM OF THE IMPROPER WORKING EJECTOR
A
E
FIGURE 3

(a) The friction losses in the expansion nozzle.

(b) The impact losses during entrainment.

(c) The losses in the diffuser.

Due to the development of steam turbines the nozzle design has approached nearly the highest degree of efficiency possible, and the friction losses in a well-designed steam nozzle are seldom more than 10 per cent. (see H. Frederic and Kemble, Transactions of the American Society of Mechanical Engineers, 1909). These losses depend mostly on the length of the nozzle and the condition of the inner surface. The loss due to impact is influenced by the relation that the momentum of the steam, plus the momentum of the air before the impact, must equal the momentum of the co-mingled steam and air after impact. If we designate the amount of live steam to be G_1 pounds, the amount of air entrained G_2 pounds, the velocity of the live steam at the outlet of the nozzles V_1, the velocity of the air V_2, and the velocity of the mixture V_3, we can write the following equation:

$$G_1 \times V_1 + G_2 = V_3 \times (G_1 + G_2).$$

The impact loss can be minimized by letting the air acquire a higher velocity before combining with the steam jets. This, however, would make it necessary to produce a smaller absolute pressure in the entrainment space and to provide an annular air nozzle ahead of the same. As a result the pressure rise in the diffuser would have to be greater than otherwise, and consequently the loss in the diffuser will be increased. Careful experiments and calculations have shown a certain range of conditions within which the sum of all the losses is a minimum. The under-expansion and arrangement of an air nozzle prior to the entrainment has been found to be of advantage only for very small compression ratios, which, however, are not used in steam air ejectors producing high vacuum.

The losses in the diffuser are considerably larger than those in the nozzle. They range from 25 per cent. to 50 per cent. and are influenced by the length and the shape of the diffuser, as well as by the conditions of the inner surface. The ratio of compression is the ratio between the absolute pressure of the air at the air intake and that at the air discharge.

Since turbine condensers require vacua of 2-in. Hg. absolute or less, the ratio of compression has to be 1 to 15 or more. While it is possible to obtain such a high compression ratio in a single stage, carefully made experiments have shown the inadvisability of using such a high compression ratio single-stage ejector for practical purposes. The conclusion, which is given in the succeeding paragraph, will illustrate why.

Assumed that a single-stage air ejector is designed to produce a vacuum of 2 in. Hg. absolute. When starting this ejector, the absolute pressure at the air intake is the same as that at the air discharge, namely, atmospheric pressure. The steam will leave the nozzle with considerably less velocity than that which it would obtain under normal operation. The efficiency of the nozzle will be decreased, and the entrainment surface (outer surface of the steam jet) will be decreased. The air to be entrained is in a less rarefied state, hence the loss due to the impact during entrainment is also greater. Consequently the velocity of the mixture is smaller and its volume is larger. As this mixture has to pass through the throat of the diffuser, the sectional area of the diffuser would have to be enlarged for starting conditions. If this is not done, starting will become impossible. Assumed that the steam jet after leaving the nozzle does not touch the diffuser walls, but leaves an annular opening or channel between the outer surface of the steam jet and the inner walls of the diffuser through which the air is entrained (as shown in Fig. 4) a vacuum will be produced which will gradually increase with the decrease of the losses. The velocity of the steam will increase with the vacuum. This in turn will retard the enlargement of the diameter of the steam jet. The increasing difference of pressure in the diffuser will recede farther towards the diffuser throat. And if the designed vacuum is obtained before the steam jet touches the diffuser wall the ejector will start spontaneously.

If, however, the jet touches the diffuser walls before the designed vacuum is obtained, the entrained air cannot pass. It will re-circulate, as illustrated by the arrows in Fig. 5, and the ejector will never start. This will happen if a single-stage ejector is designed for 2-in. Hg., because its diffused throat area will be entirely too small for starting conditions. If increased in sectional area to overcome those, the section will be too large to be filled out with the co-mingled steam and air at 2 in. absolute, and atmospheric air will rush back into the entrainment space and the desired vacuum will not be obtained. To overcome this difficulty such a single-stage high-compression ratio ejector would have to be provided with either a flexible diffuser or special arrangements for starting.

In all ejector designs, whether for low or high compression ratio, the above facts have to be given careful consideration. The diffuser throat is generally enlarged over the required size for design conditions. This enlargement represents a compromise between diffuser losses and the self-starting capacity. The latter is more important than high efficiency. In practical installations vacuum conditions vary, and lack of this self-starting characteristic will cause the ejector to stop working, which may have serious consequences. Experiments have shown that the maximum ratio of compression for a single-stage ejector working in connection with condensers should not exceed 1 to 7. In other words, when it is desired to have more than 25½ in. vacuum with 30-in. barometer, it is advisable to arrange two ejectors working in series and divide the ratio of compression. All high-vacuum ejectors used with marine-turbine condensers consist of two stages —the first stage, which is connected to the air suction of the condenser and which exhausts into the second stage at a pressure varying from 4-in. to 10-in. Hg. absolute; the second stage, which compresses the mixture of steam, air

Fig.6. CURVES ILLUSTRATING AIR HANDLING CAPACITIES OF A TWO STAGE EJECTOR AT DIFFERENT VACUA.

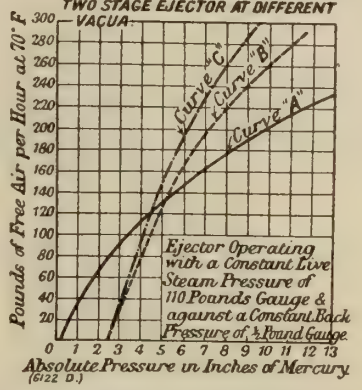

Pounds of Free Air per Hour at 70° F.
Curve "C"
Curve "B"
Curve "A"
Ejector Operating with a Constant Live Steam Pressure of 110 Pounds Gauge & against a Constant Back Pressure of ½ Pound Gauge
Absolute Pressure in Inches of Mercury
(6122 D.)

Fig.7. CURVE ILLUSTRATING THE INFLUENCE OF VARIATIONS IN LIVE STEAM PRESSURE

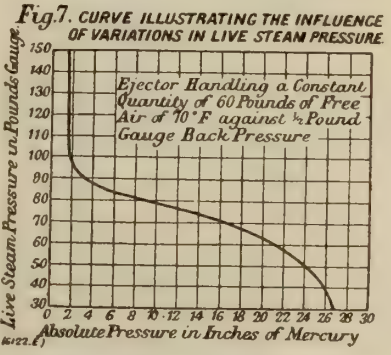
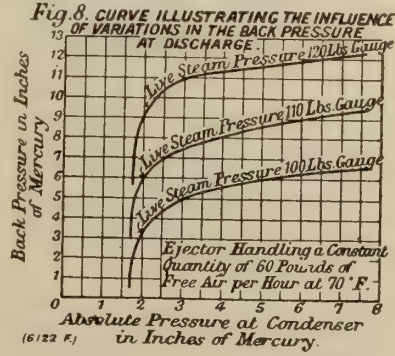

Live Steam Pressure in Pounds Gauge
Ejector Handling a Constant Quantity of 60 Pounds of Free Air of 70° F against ½ Pound Gauge Back Pressure
Absolute Pressure in Inches of Mercury
(6122 E.)

Fig.8. CURVE ILLUSTRATING THE INFLUENCE OF VARIATIONS IN THE BACK PRESSURE AT DISCHARGE.


Back Pressure in Inches of Mercury
Live Steam Pressure 120 Lbs Gauge
Live Steam Pressure 110 Lbs Gauge
Live Steam Pressure 100 Lbs Gauge
Ejector Handling a Constant Quantity of 60 Pounds of Free Air per Hour at 70° F.
Absolute Pressure at Condenser in Inches of Mercury
(6122 F.)

and vapour received from the first stage to a pressure slightly above atmosphere. The steam used in both stages, while passing through the ejector, gives up its energy, but does not lose its heat, with the exception of some small losses due to radiation. The exhaust from the ejector is discharged into the feed tank. The heat in the steam is by this means transmitted directly to the boiler feed with practically no loss.

The characteristic of the performance of the steam-air ejector is illustrated in Fig. 6. Curve A shows the air-handling capacity of a two-stage ejector designed for 2 in. absolute at different absolute pressure when exhausting dry air and when being supplied with a constant quantity of dry saturated steam of constant pressure, and when exhausting against a constant back pressure of ½-lb. gauge. It will be noted that the air ejector is capable of producing an absolute pressure of 0.25-in. Hg. at dead end (with the air suction blanked off). The capacity increases steadily with the increase of absolute pressure. The actual dry-air handling capacity of the second stage of the same ejector working under similar conditions is illustrated in curve B. The steam consumption of the second stage is, of course, less than the total steam consumption of the two stages. Curve C, shown in a dot-and-dash line, represents the air-handling capacity of the second stage based on the total steam consumption of the two-stage ejector. Comparing these curves it will be noted that at 5 in. Hg. absolute the second stage alone handles as much air as both stages together, and that from this point the capacity of the second stage increases over that shown in curve A. This is due to the fact that, when both stages are working, the second stage also compresses the steam discharged from the first stage. One is accordingly led to the conclusion that it is advisable to shut off the steam supply to the first stage at about 5 in. Hg. absolute to save the live steam used in the same. Curve C also indicates that at about 4.5-in. Hg. absolute or more a single-stage air ejector should be used, provided it can be designed self-starting. In connection with Fig. 6, it must not be assumed that the curves indicated are in every sense absolute. They depend entirely upon the ratio between the compression ratios of the first stage and those of an ejector which has been extensively used in marine installations.

The main factors (excluding those referring to the design), controlling the performance of a steam-air ejector are: (a) The quality of the live steam supplied; (b) The pressure of the live steam supplied; (c) The back pressure at the discharge; (d) The condition of air handled.

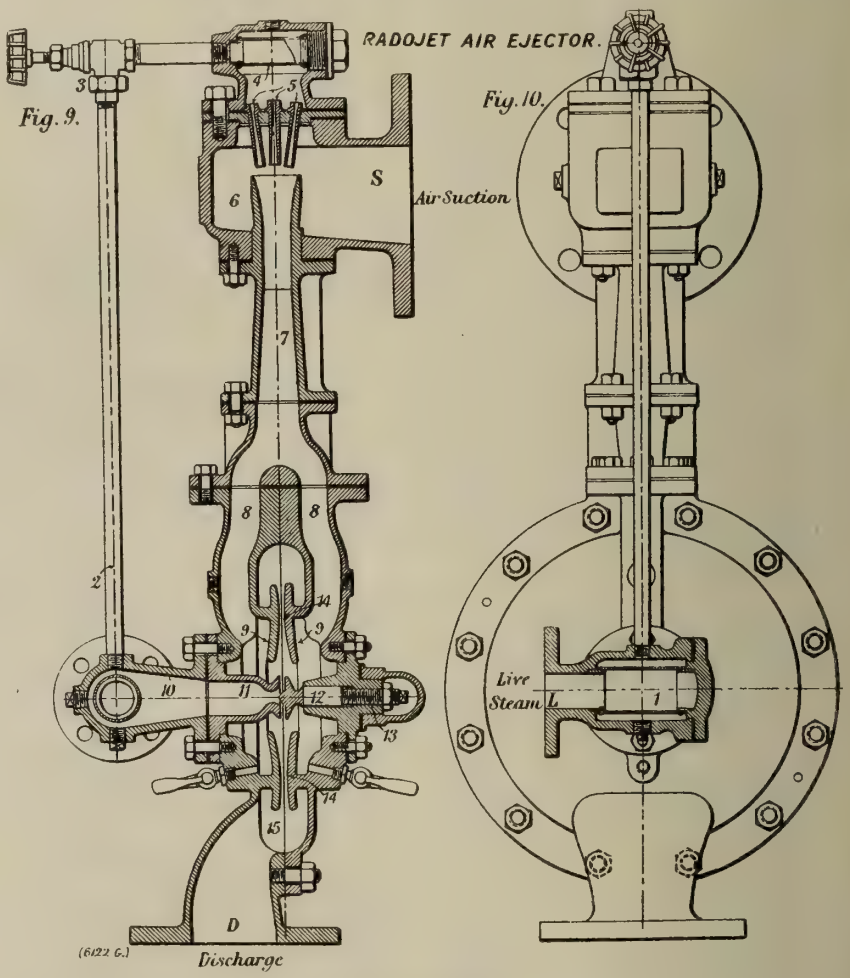
The live steam supplied to the steam-air ejector should be dry saturated or slightly superheated. If less than 98 per cent. saturated, the losses will rapidly increase and the stability of operation will suffer. The presence of water in the steam can easily be detected by a whistling noise and a sudden drop of pressure of the steam at the pressure gauge arranged ahead of the inlet to the nozzle. If the possibility of obtaining wet steam exists, a steam separator should be provided.

High superheated steam, while good for steam turbines, does not offer any advantages for the steam-air ejector. Its compression in the diffuser becomes difficult, and this counterbalances the benefit obtained from its use in the nozzles.

The necessary minimum pressure of the live steam at the inlet to the nozzles is a function of the compression ratio the ejector has to produce. The kinetic energy of the steam, after expansion through the nozzle, has to be large enough to compress the mixture of steam and air. The minimum steam pressure employed varies from 100 lb. to 110 lb. gauge. The influence of the variation in steam pressure on a two-stage air ejector designed for 100 lb. gauge removing a constant quantity of air against a constant back pressure is shown in Fig. 7. It will be noted that even low steam pressures will produce some results.

The effect of the back pressure upon the performance is illustrated in Fig. 8, several curves for different live steam pressures being shown. All are based upon a constant air-handling capacity. These curves also evidence the possibility of overcoming a higher back pressure by an increase in the live steam pressure.

The effect of the conditions of the air entrained is based upon the following considerations: Air saturated with water vapors weighs considerably more than dry air. Since we can assume that the ejector will handle the same total weight whether the air is dry or saturated, the application of the Dalton law (see Fig. 2) will enable the determination of the respective quantities. Referring to curve A in Fig. 6, at 2-in. Hg.,, absolute, 77 lb. of dry air were handled when drawn directly from the atmosphere. Assume now that fully-saturated air is to be handled at the same absolute pressure and that this air has a temperature of 80 deg. F. The curves of Fig. 2 indicate the presence of 0.67 lb. of water vapor to each pound of dry air in 1.66 lb. mixture. Hence the ejector would theoretically handle $\frac{77}{1.67} = 46$ lb. of dry air. Careful experiments have shown the amounts actually handled to be less than the calculated theoretical values. This is partly due to small globules of water suspended in the saturated air being carried into the ejector. An air ejector handling a mix-



FIGS. 9 AND 10.

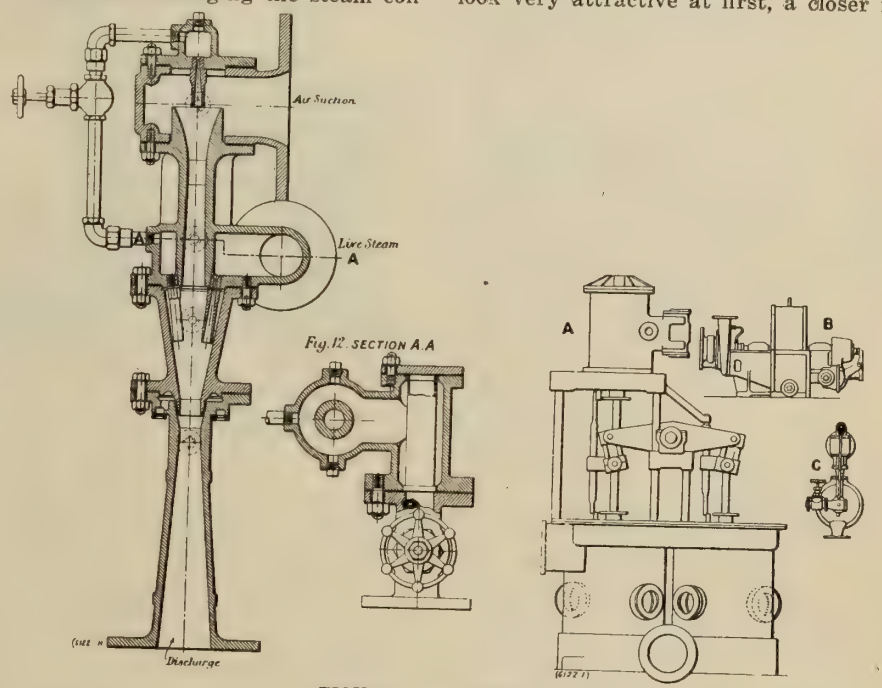
ture containing a considerable amount of vapor also has greater impact losses during entrainment and greater losses in the diffuser. The weight of mixture handled by the ejector becomes less as the proportion of vapor to dry air increases. Since the air withdrawn from a condenser is always saturated with water vapor, the above-mentioned condition should receive careful consideration when selecting the proper size of an air ejector for a condenser installation.

Having thus briefly indicated the principles of operation, as well as the most important factors in steam air-ejector design, several types of ejectors will be described which have been in successful operation in marine condensed installations over two years, and thereby have proven their fitness for marine service. Only two types in a variety of sizes have so far been used in a large fleet of merchant marine and navy vessels. These are known as the "Radojet" and the Le Blanc air ejector. Both are of the two-stage type, the stages being connected in series. A cross-section through the "Radojet" is shown in Fig. 9. Live steam is delivered from a source not shown through opening L, Fig. 10, through strainer screen 1, Fig. 9, pipe 2, auxiliary steam valve 3, strainer screen 4, expansion nozzles 5, across suction chamber 6, of the first stage ejector, which is in communication with the condenser through the suction opening S. The steam expands in the nozzles, leaving the same with a very high velocity and, while passing across suction chamber 6, entrains the air and vapors to be compressed. The mixture passes into the diffuser 7, from where it is discharged at higher absolute pressure than that of the air entering at S into a double passage 8 communicating with the suction chambers 9 of the second stage. These two suction chambers 9 are annular giving the co-mingled fluid a large entrainment surface. Steam is simultaneously delivered through the strainer screen 1 into passage 10, which communicates with the annular expansion nozzle formed between nozzle 11 and nozzle point 12. Nozzle point 12 may be adjusted toward or away from disc 11 by the adjoining screw 13 which forms part of it, to vary the cross-section of the nozzle passage, thereby changing the expansion ratio of the steam. The steam delivered by the annular nozzle 11 expands between the same and nozzle point 12, leaving it as a jet of high velocity in the form of an annular sheet. In passing across the section chamber 9, it entrains the co-mingled air and steam received from the first stage and carries the mixture into the annular diffuser 14, thereby compressing it to slightly above atmospheric pressure and discharging it into casing 15, which has the discharge opening D. The steam nozzles of the first stage are bronze, that of the second stage is of monel metal, and the nozzle point of special steel. The diffusers are bronze. In the smaller sizes, the diffusers form part of the casing, while in the larger sizes the diffusers are secured to a cast-iron casing by bolts forming a metal ground joint with the casing. The strainers ahead of the nozzles protect them from becoming clogged by foreign substance. They are easily removed and are made of perforated monel metal or monel metal wire gauze. The openings in the strainers are smaller than the throat of the nozzles.

The particular features of this type of air ejector are: (1) The use of a radial jet (from which the "Radojet" has derived its name), which has a greater penetrating force and larger enterainment surface than that of a cylindrical jet of equal length. Consequently better efficiencies are obtained. (2) The possibility of adjusting the expansion ratio of the live steam from the outside without changing the steam consumption. Referring to Fig. 9, it will be seen that the throat is located in nozzle 11 and that any movement of the disc to or fro will not change the cross-sectional area of the throat, and therefore not affect the steam consumption.

A cross-section through the "Le Blanc" air ejector is shown in Fig. 11. It has one De Laval nozzle in the first stage, and multiple De Laval nozzles are arranged close to the inside of the diffuser walls in the second stage. It is claimed that the losses due to the impact in the second stage are reduced since the mixture discharged from the first stage enters with greater velocity and in a direction nearly parallel to the steam jets of the second stage. The throat of the diffuser in the second stage also has an opening connected with the atmosphere. The object of this opening is to permit the air thus drawn in to form a flexible diffuser wall. At starting and at low vacua the pressure at the diffuser throat will be atmospheric. With the increase of vacuum this pressure will be lowered and the inrushing air will partly fill up the diffuser throat, thereby decreasing the effective area. While this arrangement conforms with the principle of self-starting as outlined above, it adds to the work of the second stage, as the air thus admitted has to be compressed and ejected.

There are also a number of other steam-air ejectors on the market, none of which to the writer's knowledge have been in operation for marine service. All of these have an inter-condenser between the first and second stage. The object of this inter-condenser is to reduce the work of the second stage by condensing the steam discharged from the first stage, thereby decreasing the total steam consumption 30 per cent. to 40 per cent. While this scheme may look very attractive at first, a closer investigation will show that there is no advantage in using an inter-condenser between stages in marine installations.



FIGURES 11, 12 AND 13

On board a ship it is necessary to install a surface inter-condenser. The heat contained in the steam of the first stage is entirely lost, as it is absorbed by the circulating water. Provision has to be made for removing the condensate from the inter-condenser. Circulating water has to be supplied to the inter-condenser, which means additional work. The weight of the inter-condenser air ejector with its necessary piping is about eight times that of the straight two-stage ejector. The space required is five times as large and the arrangement of the piping is complicated. The increased weight and the larger space required mean a slight increase in propelling power. Space and weight also make it difficult to provide two or three steam-air ejectors with inter-condensers working in parallel. Such an ar-

rangement can easily be made with a steam-air ejector without an inter-condenser and has the advantage of increasing the flexibility and economy during light loads. The gain in steam consumption by using the inter-condenser is more than counterbalanced by all the disadvantages mentioned. The arrangement with an inter-condenser also lacks the simplicity which a two-stage air ejector installation without inter-condenser possesses. According to the opinion of numerous marine operating engineers, simplicity is of greater practical value than the saving of a few pounds of live steam. Until the appearance on the market of the steam-air ejector the twin-beam air pump quite monopolized the field. Therefore it will be interesting to compare the two types.

Considering first the comparative steam consumptions based on equal air and condensate handling capacity it will be found that the steam consumption of the air ejector, plus that of a turbine-driven condensate pump, is lower than that of the twin-beam air pump, even if the latter is arranged with a dry and a wet cylinder. The weight and space requirements are also decisively in favor of the air ejector outfit. Fig. 13 gives comparative outlines of twin-beam air pump and air ejector of equal air and condensate handling capacity, and Table 1 below gives the relative weight, cubical space and floor space.

TABLE I.

	Weight	Cubical Space	Floor Space
	lb.	cub. ft.	sq. ft
Twin-beam air pump..	14,500	375	33
Two air ejectors and one condensate pump	2,100	18	8

Other comparative advantages of the air ejector are: It has no moving parts or valves, does not require lubrication, nor attendance during operation. Its operation is noiseless, simple and reliable. No foundations are required and no restriction as to location exists. It is to all intents and purposes a piece of pipe. Since there are no moving parts there is no wear, and consequently the maintenance costs are practically nil.

When using a steam-air ejector the feed water carries less absorbed air into the boilers than when using a twin-beam pump. The condensate pump forms a self-contained unit. All the attention it requires is to see that its ring oiling bearings are kept filled with oil. The discharge head of the condensate pump is not limited, as is the case with the twin-beam air pump. Since it operates independently from the air ejector the pump has greater flexibility and can easily take care of large amounts of condensate without influencing the air-handling capacity. This is not possible with the twin-beam air pump, in which the air-handling capacity is limited by the piston speed and simultaneously by the amount of condensate removed.

When using air ejectors and condensate pumps a considerable saving in weight and cost of piping can be made because the pipe sizes are smaller, as much higher velocities are permissible when dealing with water and air separately. Steam-air ejectors are generally supplied in pairs for marine condenser installations, this subdivision having the advantage of reducing the steam consumption by operating with one under light loads or when the installation is airtight, also of providing additional capacity in case of unexpected leakage. In larger installations sometimes three or even four air ejectors working in parallel are being used with two condensate pumps. This subdivision also gives an absolute assurance against a total shutdown, which may easily occur when using a single reciprocating type air pump. As the condensate pump forms an essential part of an air-ejector installation a short description of several types of condensate pumps will be given.

A centrifugal type of condensate pump by the Wheeler Company, driven directly by a steam turbine, has been extensively used. It has a shingle-inlet impeller mounted on the overhung end of the turbine shaft. The pump casing is bolted directly to the turbine casing, thus forming a rugged unit with only two bearings. This construction makes it impossible to throw the shaft out of alignment when bolting the pump down to the foundation or when connecting the piping. A vent is provided ahead of the inlet of the impelled and connected to the condenser to permit any air which may have been drawn into the pump through whirling of the condensate as it enters the suction pipe to return to the condenser and prevent the pump from becoming air-bound. The turbine is running at a constant speed which is regulated by a speed governor; it also has an emergency trip. Carbon packings are generally used on the turbine glands. The pump has to remove condensate under a high vacuum, and therefore has to overcome a suction head of 30 feet or more. This makes it necessary for the condensate to flow by gravity to the pump impeller, and it is advisable that the pump be submerged not less than 2 feet below the lowest water level of the condenser.

Direct-acting reciprocating piston pumps, either vertical or horizontal, are also used for the removal of the condensate. Their design is adapted to the features peculiar to condensate pump service. Their submergency is more than that for the centrifugal type, and is never less than 4 feet from the top of the discharge valves to the water level of the hot well. The stuffing-boxes are water sealed, and their piston speed does not exceed 25 feet to 30 feet per minute when handling double the normal capacity. The speed of the pump is controlled by a float arranged in the hot well of the condenser so as to prevent racing of the pump at light loads.

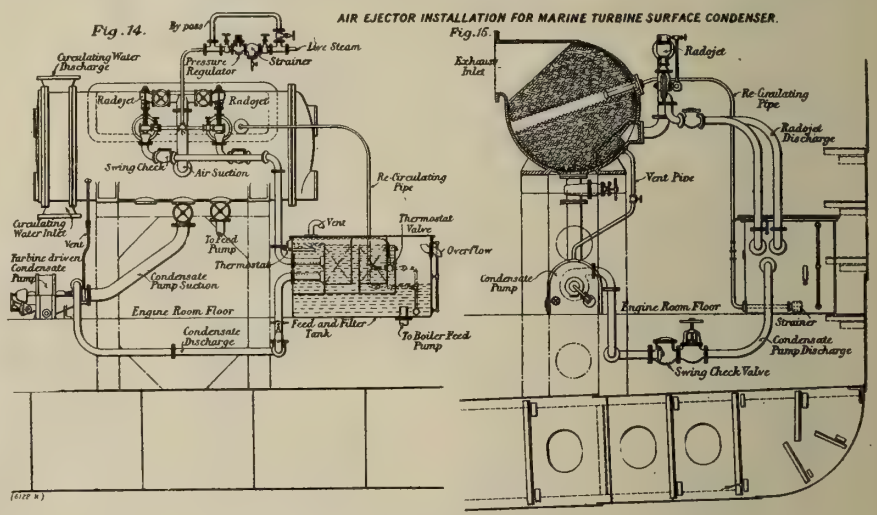


FIGURE 14

The arrangement of an air-ejector installation with turbine-driven condensate pump is illustrated in Figs. 14 and 15. Live steam at boiler pressure is delivered through the steam strainer to the pressure regulator; passing through the pressure regulator the steam is delivered to the main steam valve of the air ejectors at practically a constant pressure for which these have been designed to operate, the pressure regulator taking care of variation in the boiler pressure. The suction of the condenser is connected to the air suction of the ejectors by a tee, a gate valve being arranged so as to permit the shut-off of each ejector. The discharge of the ejectors leads into the feed and filter tank. A swing check valve is arranged close to the tank to prevent any water from rushing back into the air ejector if shut down before breaking the vacuum in the condenser. Inside the feed and filter tank the mixture of steam and air is discharged through a submerged pipe perforated at

the bottom. By coming into contact with the water the steam is condensed while the air, forced to rise by the upward flow of the water, is liberated, escaping through a vent arranged in the top of the tank. Water is continuously supplied to the feed and filter tank by the turbine-driven centrifugal condensate pump, which delivers the condensate into the filter tank through a swing check valve, gate valve and a perforated pipe with holes diametrically opposite to that of the ejector discharge pipe. A vent pipe is arranged between the suction inlet of the condensate pump and the condenser. A re-circulating pipe, with a strainer, a thermostatically-operated valve and a globe valve, is provided between the feed and filter tank and the condenser to insure at all times a sufficient water supply for condensing the steam from the air ejectors.

During manoeuvring or while at sea, the main engine or turbine supplying the condenser with exhaust steam may stop, consequently very little condensate will be delivered by the condensate pump to the feed and filter tank, and not sufficient to condense the discharge from the air ejector which at the time is in continuous operation. To prevent a rise in temperature of the water in the feed tank over the desirable (usually 140 deg. F., depending, however, on the general arrangement of each individual installation), a thermostat is arranged in the feed and filter tank, controlling the thermostatically-controlled valve. As soon as the water reaches the temperature for which the thermostat is set, the latter will open the thermostatically-controlled valve and the vacuum will draw water through the recirculating pipe into the condenser. By falling over the cool condenser tubes (the circulating pump, of course, being in operation), this water will be cooled and returned by the condensate pump to the feed and filter tank thus preventing any further rise in temperature until the exhaust from the main engine again supplies sufficient condensate.

This arrangement makes the air ejector installation absolutely reliable, even if operated by inexperienced attendants. Starting is easy, as it requires only the opening of two steam valves, one for the turbine driving the condensate pump and one for the air ejector. During operation no attention is required and, to shut down, only these two valves have to be closed.

A diagrammatic arrangement of an air-ejector installation with a direct-acting reciprocating piston pump is shown in Fig. 16. This arrangement is generally applied to marine reciprocating engine surface condensers and is similar to that for marine turbine surface condensers already described. The only difference is that the speed of the reciprocating piston pump is controlled by a float arranged in the hot well. The steam-air ejector was first tried on board ship about four years ago. It was feared that, by discharging the co-mingled steam and air into the feed tank, the amount of air absorbed by the feed water would be greater than when using a reciprocating piston air pump. Comparative tests have shown that this fear was groundless. The amount of air absorbed in the feed water when using the ejector, was 35 per cent. less than that when using the twin-beam air pump. With this obstacle removed, the air ejector rapidly gained the confidence of shipbuilders and marine engineers, so that there are to-day to the writer's knowledge over 500 ships built in the United States equipped with steam-air ejectors. About one-third of these have been in successful operation for periods up to two years. From this it would appear that the steam-air ejector to-day occupies a position among the air pumps similar to that occupied by the steam turbine among steam-operated prime movers. Its advantages, reliability and simplicity, are dominating factors which will gradually make its adoption as universal as that of the steam turbine.

Fig. 16. AIR EJECTOR INSTALLATION FOR MARINE ENGINE SURFACE CONDENSER.

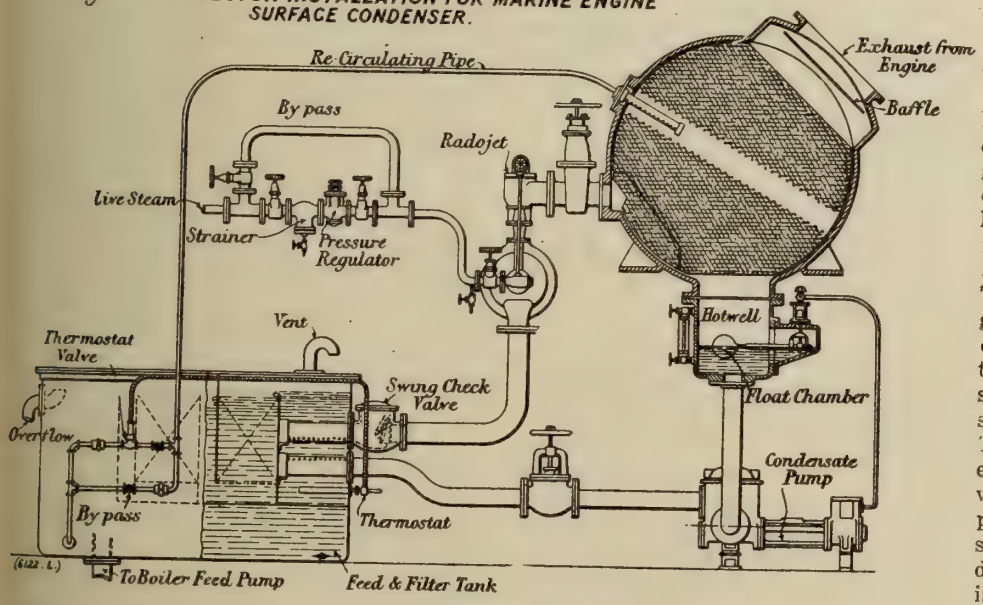


FIGURE 10

LAUNCHING OF THE S.S. "GIULIO CESARE"

Messrs. Swan, Hunter & Wigham Richardson recently launched from the berth once occupied by the famous Cunard R. M. S. "Mauretania," at their Wallsend Shipyard, a magnificent liner of some 20,000 gross tons which is being built for the Navigazione Generale Italiana, of Genoa. This ship, called the "Giulio Cesare" is to run in the owners' service between Genoa and Buenos Aires, and will be one of the most luxurious of the many passenger liners plying between Europe and Argentina. The overall length of the "Giulio Cesare" is 633 feet, and her breadth is 75 feet, with a moulded depth of a little over 50 feet. The ship has a straight stem and cruiser stern.

The propelling machinery and boilers have been built by the Wallsend Slipway & Engineering Co., Ltd. The main engines consist of four geared turbines driving four propellors. The high and low pressure turbine units work in series, which arrangement applies both to ahead and astern direction of rotation. The steam is superheated up to 200 degrees F., on entering the turbine manoeuvring valves. In case of a breakdown to any of the turbines, they are arranged so that the high pressure and low pressure units can be operated independently. There are six double and four single ended multitubular boilers placed in four watertight compartments. The working pressure of the boilers is 222 lbs., per square inch, under Howden's forced draught. The designed speed of the ship is 19½ knots on a 24 hours' continuous trial.

The "Giulio Cesare" has eight decks, which are chiefly occupied with accommodation for 1,800 passengers, of which 210 are first class, 310 second class and the remainder emigrants. In addition to this, there is accomodation for over 500 persons comprising the officers, crew, stewards, etc. A great feature in the first class passenger accomodation is the very large number of "cabines de luxe" arranged on five decks. The public rooms and galleries leading from the promenade deck, and also the first class dining saloon, are particularly noticeable for their great height which is very much more than is usually found in ships. Among the other attractions in the ship there will be a well-equipped gymnasium, and a children's dining-room. The forward part of the upper promenade deck will be protected by large sash windows which can be opened at will. To add to the comfort of passengers, Frahm's anti-rolling tanks are built in the ship. The ventilation throughout the ship is of the Thermotank system, whereby either cold or warm air can be carried into every

SS. "GIULIO CESARE."

compartment on all decks where there is living accomodation. Arrangements are also made for exhausting vitiated air.

The "Giulio Cesare" is fitted throughout with hydraulic lifting gear for passengers' baggage, stores, and a small amount of cargo. An extensive electric generating plant will be installed in the ship for lighting, and also to work the first class passenger lift, and other lifts dealing with stores, etc. For the provision-rooms there will be a large installation of refrigerating machinery supplied by Messrs. J. E. Hall, of Dartford.

The "Giulio Cesare" is being built to the requirements of the Registro Nazionale Italiano, of Lloyd's and of the British Corporation. She will also fulfil the provisions of the Merchant Shipping Laws of Italy, Great Britain and the United States of America, especially as regards carrying passengers and emigrants. When designing the ship, a great deal of attention was paid to ensure her safety as far as possible by providing a sufficient number of watertight compartments. A very effective installation of watertight doors controlled from the bridge is being installed by Messrs. J. Stone & Co., of Deptford, London. On the boat deck, Welin's patent davits are fitted. Electric boat winches are provided for lifting all the midship lifeboats, which include two motor boats. The ship also carries submarine signalling apparatus which will be invaluable for picking up position in fogs.

Turning the "Empress of Britain" Into an Oil Burner

AN interesting feature of the present reconstruction period is the re-instating of the large passenger vessels which by reason of their speed and radius of action were able to serve for cruiser patrol and convoy escort duty during the war.

The C. P. O. S. "Empress of Britain" commissioned in August, 1914, served on the South Atlantic patrol and after close on a year of service was fitted out as a transport carrying troops to the Dardenelles, Egypt, India; also from Canada for the Western Front during the remainder of the period of hostilities. The nature of the service may be appreciated from the fact that she was able to accommodate 5,000 officers and men in addition to her own complement.

The Canadian Pacific Ocean Services, Ltd., who have placed her in the hands of her builders, The Fairfield Shipbuilding and Engineering Co., for reconditioning and the carrying out of extensive alterations which have as an object the provision of most luxurious and up-to-date conditions for passengers, are also arranging for her conversion from coal to fuel oil burning.

The bunker capacity sufficient for round voyage requirements, Liverpool—Quebec, viz.: 3,500 tons, has been obtained by converting the original coal bunkers suitably for the carriage of fuel oil. The boilers, which are contained in two separate watertight compartments, are of the multitubular return tube (Scotch) type there being 6 double-ended and 4 single-ended with 60 furnaces. All boilers are under Howdens system of forced draught, and supply steam at a pressure of 200 lbs. per square inch. The indicated horse-power of the twin quadruple expansion engines is 18,000. With oil fuel burning there is an increase in boiler efficiency of 7 per cent. while the utilization of the whole of the furnace perimeter throughout the length, as effective heating surface, results in improved circulation and diminution of the distorting strains which cannot be avoided under conditions of coal burning.

Owing to the higher calorific value of oil the evaporation is considerably increased and the weight of oil in comparison with coal required for equivalent evaporation is in the rough proportion of 2 to 3. The increase in propulsive efficiency which results from maintenance of steady head of steam in comparison with inevitable drop during period of cleaning coal fires, and fuel economy by elimination of disposal of ashes at sea, are important features governing the adoption of oil burning. With this vessel under conditions of coal burning it is necessary to discharge overboard 30 tons of ashes per day.

The cleanliness of machinery spaces where oil fuel is used is well known, and a definite saving is effected in handling of stokehold bilges, while the reduction in upkeep expenses due to lower deterioration of structure is appreciable.

It will be seen that from the labor point of view the stokehold complement work under conditions improved to an extent which render them incomparably more comfortable than they were when undertaking the arduous duties associated with coal firing.

The laborious work of coal trimming is replaced by pumping, and the old time fireman becomes a boiler attendant, who, under the guidance of the engineer officer regulates the supply of oil to the boiler furnaces and attends to the cleaning of the oil burners.

Reverting to the bunkers, these are being suitably arranged for the carriage of fuel oil of a minimum flash point 150 deg. F., and special provision is being made for the efficient carriage and handling of heavy grade Mexican fuel oil. The suction pipes are large bore for assistance in pumping, bains being 8-in. and branches to bunkers 4-in. bore. Heating coils are being fitted in the bunkers to ensure maintenance of the necessary fluidity, when in cold climates. The system of working is generally as follows:

Oil transfer pumps draw from fuel bunkers and discharge to settling tanks of a capacity sufficient for 24 hours supply. Oil fuel pumps draw from settling tanks through suction strainers and discharge through heaters to burners which are arranged in the boiler furnace fronts. Oil filters are fitted in the line of discharge from heaters to burners and oil meters for measuring quantity used are also incorporated in the pipe lines. The system adopted is on the Wallsend-Howden principle, burners being "Dahl" patent.

For normal working, oil is heated to 200 deg. F., and delivered to burners at a pressure of 100 lbs. per square inch. This combination in conjunction with burner nozzle which is arranged to give conical spray, ensures that degree of atomizing of the oil which is essential for the obtaining of complete combustion. This atomizing is an important factor in oil burning, as, should large globules of oil enter the furnaces, the outer skin only becomes charred, resulting in an oily mass being deposited in the smoke tubes.

Each boiler has its own separate equipment, comprising, one oil transfer pump of the Weirs vertical type, and oil fuel sets in duplicate, each consisting of Weirs pump and oil fuel heater of capacity suitable for the supply of one complete section of boilers. The feed pumps are Weirs horizontal type cast iron fitted, while heaters are capable

or raising temperature of oil to 320 deg F., when working under steam supply, at the pressure of the exhaust which is normally 5 lbs. per square inch.

There are therefore 4 separate oil fuel sets and each has a designed capacity of 12,500 lbs. oil per hour. The oil circuits are arranged to facilitate warming up prior to starting all or any of the boilers which may have been out of use, and the fuel may be circulated past the burners after passing through the heaters. Valves for regulating supply of oil to burners have been grouped for convenience in handling.

The air supply requisite for combustion of the fuel is delivered to furnaces under Howdens system of forced draught by 8-72-in. double inlet fans of the centrifugal type each driven by 30 BHP, protected type adjustable speed motors, shunt wound with series steadying turns, speed of revolution being 500 per minute on 100 volt circuit. For convenience in starting after vessel has been in port some days, special lighting up heaters are provided, these being Admiralty T. B. D. type.

To facilitate ready checking of combustion conditions a system of smoke observation mirrors is included and operating staff will therefore be able to verify adjustments for economy without leaving the boiler-room.

Special attention is being given to the lighting and ventilation of boiler-rooms, while the painting of spaces, hitherto dark and dirty, as is inevitable with coal burning, will make for increased efficiency in operation.

BRITISH FIRM ACQUIRES SOUTH AMERICAN YARD

Yet another shipyard of the Western Hemisphere has come under British management, so that there are now fully equipped yards intimately associated with some of the best shipbuilders in this country on the shores of the Northern Pacific and both Atlantics. The latest establishment to be taken over by a British firm is that of the Costeira Company of Rio de Janeiro, while the new owners are J. I. Thornycroft & Co., Ltd., of London and Southampton. The Costeira Company has a yard with several building ships on the Ilha do Vianna, together with all the usual machinery shops in which engines and boilers of considerable size can be constructed. There is also a dry dock, capable of accommodating vessels up to 400 feet long, which was blasted out of the solid rock.

A general manager, shipyard and engineering managers, draughtsmen, accountant, and a number of skilled men of every trade represented in the shipyard have been sent out from Thornycroft's works at Woolston, in order to give the new business the best possible start and to ensure its development on proper lines. The Ilha do Vianna establishment will necessarily work in very close touch with the Thornycroft firm in this country, and the technical advice and experience of the latter will be available to the staff in Brazil.

The works have been established in Rio de Janeiro for a considerable number of years, but during the war developments and improvements were made, and it is intended that that policy should be energetically continued. The works have accommodation for the men and staff and all other necessary facilities, and are self contained on the one island —an ideal arrangement from many points of view, and particularly so from the health point of view in Brazil.

The Costeira yard is noteworthy as having turned out the first ocean-going steel steamer built in South America, the Itaquatia. She is a 4,000-ton twin-screw ship, 288 feet long between perpendiculars and 300 feet overall, with a moulded breadth of 43 feet, and a depth of 18 feet 9 inches. The main engines are of the triple-expansion type, with cylinders 16 inches and 26 inches and 42 inches in diameter by 30-inch stroke. The two sets of engines develop 1,800 indicated horse power and are supplied with steam at 180 lbs. per square inch by two boilers 15 feet 9 inches in diameter by 11 feet 6 inches long. The Itaquatia, we may say, was launched in the presence of the President of Brazil in December last. The yard in which she was built was previously mainly engaged on ship repair work, and at the present time employs about 1,500 men. Needless to say, there is plenty of opening for that class of work in Rio.—*The Engineer.*

NEW MONTREAL SALES OFFICE

The Engineering & Machine Works of Canada, Limited, St. Catharines, Ontario, owing to the rapidly increasing demand for their products consisting of boilers of all types, horizontal, vertical, locomotive and marine, tanks, plate work of all descriptions, etc., and particularly in connection with their recent and very successful venture, the manufacture in Canada of the Keystone Light Traction Excavator, Model 4, have found it necessary to open another eastern sales office in the Birks Building, Montreal, where inquiries can be more quickly and satisfactorily handled. This is in addition to their sales office in the Sun Life Building, Sherbrooke, Que.

NEW BOOK OF TABLES

The Wheeler Condenser & Engineering Co., Carteret, N. J., announce the publication of the 1920 edition of their popular "Steam Tables for Condenser Work." This is the fifth edition. Every engineer who deals with the condensation or evaporation of steam should have one of these handy tables. The pressures below atmosphere have been especially calculated for this book by Prof. Marks.

The book gives the properties of saturated steam from 29.8-in. vacuum to atmospheric pressure in increments of tenths of an inch. The vacuum in inches of mercury is referred to a 30-in. barometer. This method is of course superior to the old method of giving absolute pressures in pounds per square inch, since it is customary to read vacuum in inches of mercury.

A complete table is also given of the properties of saturated steam above atmospheric pressure.

The book tells how to make measurements by means of the mercury column and barometer. It gives constants and tables for making corrections. It gives the correction to be made for relative expansion of mercury and brass scale, etc. It is a very handy book and of a size that can be carried around in the vest pocket.

SUCCESSFUL BRITISH ELECTRIC WELDING PROCESS

Rapid progress is being made with the special process of electric welding which was successfully employed by the British Admiralty during the war in the construction of a "rivetless" 1,000-ton steel barge for transport purposes. The peculiarity of this process is the use of special electrodes covered with flux which prevents the oxidation of the welding metal. Further, by using electrodes and fluxes of special composition steel of any particular character—mild steel, nickel steel, high-tensile steel, vanadium steel, and so on—can be deposited direct. Cast-iron of good quality can also be obtained by this system of welding. Extensive repairs are being carried out in worn tramway tracks, cracked omnibus wheels, and old motor car shafts, and a company has been formed for the production of welded motor car wheels. An important feature is that only a moderate amount of skill on the part of the operator is required to secure satisfactory results.

The Koreans, according to the "Manchester Guardian," were the original inventors of the ironclad warship. It was in 1592, that a Japanese army landed on the shores of Southern Korea and swept northward through the peninsula. The invaders, who carried firearms, which had never been seen before in Korea, penetrated as far as Pyeng-yang, and there awaited further reinforcements before advancing to the conquest of China. The head of the Korean navy, Admiral Yi Sun-sin, determined to destroy the reinforcements before they could land, and for that purpose devised a "kwi-sun," or "tortoise-boat," so called because of its resemblance to that animal. It was covered with a curved deck of iron plates and provided with a ram. In this Admiral Yi attacked the Japanese fleet of 600 boats, ramming them right and left. As he passed on he left the struggling Japanese in the water, to be dispatched by his followers in the ordinary boats of the Korean fleet. A few Japanese boats escaped, but the backbone of the invasion was broken, and for the first time in history the virtues of a protected cruiser were demonstrated.

Captains and Engineers Appointed on the Canadian Inland Steamships

PRESCOTT AND OGDENSBURG FERRY COMPANY, LTD.

Vessel	Captain	Engineer
Miss Vandenberg	A. Black S. Delaney	Frederick Lavery.
Ferdinand	E. P. McGannon	W. J. Jento.

ALGOMA CENTRAL STEAMSHIP LINE.

Vessel	Captain	Engineer
Agawa	M. A. Livingstone	J. L. Smith.
W. C. Franz	W. C. Jordan	A. M. McInnes.
J. Frater Taylor	J. D. Montgomery	W. T. Rennie.
Home Smith	A. McIntyre	D. McLeod.

GREAT LAKES TRANSPORTATION COMPANY, LTD.

Vessel	Captain	Engineer
Glenshee	W. A. Lavigne	P. Goodwin.
Glenisla	J. Tindall	P. Eagles.
Glenorchy	F. Burke	G. Price.
Glenfinnan	W. Taylor	J. Silverthorne.
Glenlyon	A. A. Hudson	D. A. Sinclair.
Glenlivet	M. Stalker	J. A. McChristie.
Glencairn	B. Garvie	J. Gilbert.
Glenstriven	(Unappointed)	E. Hurl.
Glenbrae	R. Burke	R. Knight.
Glencadam	G. Henebery	F. H. Brickenden.

CANADA STEAMSHIP LINES, LTD.

Vessel	Captain	Engineer
W. Grant Morden	C. E. Robinson	Jas. McGregor.
J. H. G. Hagarty	G. W. Pearson	Chas. Robertson.
Emperor	D. W. Burke	Geo. N. Smith.
E. B. Osler	J. H. Hudson	R. R. Foote.
Midland Prince	A. B. McIntyre	J. A. Pickard.
Collingwood	Peter McKay	H. J. Jack.
W. D. Matthews	A. F. McLennan	Wm. Reid.
Midland King	N. McGlennon	Chas. Leriche.
Martian	R. McIntyre	John B. McLaren.
Sarnian	R. Pyette	I. J. Boynton.
Sir Trevor Dawson	H. Hinslea	Geo. Schroder.
Stadacona	G. H. Page	W. L. Shay.
Haddington	R. J. Wilson	A. E. Kennedy.
Toiler	W. H. Montgomery	Emery Scott.
Cadillac	W. Beatty	Hugh Myler.
T. P. Phelan	E. J. Shannon	Thos. H. Hazlett.
Fairfax	H. Heffernan	F. Patterson.
Omaha	K. La Rush	John Holler.
Maplehill	H. A. Leaney	Wm. Keith.
Maplegrove	Herb. Brian	Chas. Gray.
Seguin	W. Brian	F. A. McCauley.
Ionic	Alex. Wilson	A. E. Crosthwaite.
Bickerdike	T. H. Johnson	H. W. Fletcher.
City of Hamilton	O. Patenaude	Wm. Dungan.
City of Ottawa	J. L. Baxter	John Kennedy.
Belleville	J. J. Jarrell	Geo. A. Sauve.
Wyoming	E. Walkinshaw	J. Kirk.

Passenger Steamers, Season 1920.

Vessel	Captain	Engineer
Cayuga	C. J. Smith	W. Taylor.
Chippewa	W. Malcolm	E. A. Prince.
Corona	B. A. Bongard	Joe Kennedy.
Macassa	F. J. Corson	J. A. Gunn.
Modjeska	J. Henderson	No appointment yet.
Toronto	E. A. Booth	J. E. Readman.
Kingston	A. E. Stinson	Geo. MacDonald.
White Star		
Brockville		
Montreal	F. X. LaFrance	Nap. Beaudoin.
Quebec		J. Matte.
Saguenay	J. Simard	Geo. Gagnon, Sr.
Murray Bay	W. Gagne	O. Bonin.
St. Irenee		
Three Rivers		Geo. Gagnon, Jr.
Longueuil	H. Mandeville	N. Noel.
Rapids King	Geo. Batten	Wm. Hazlett.
Rapids Prince	Sam Putnam	Geo. M. Hazlett.
Syracuse		J. A. Belanger.
Rochester		

KEYSTONE TRANSPORTATION COMPANY OF CANADA, LTD.

Vessel	Master	Engineer
Keywest	Capt. A. Barrett	Mr. Alex. Horton.
Keyport	Capt. Geo. Bunting	Mr. Geo. Jarrell.
Keybell	Capt. Leon Beaupre	Mr. R. J. Muchmore.
Keynor	Capt. Wm. Smith	Mr. John M. Robertson.
Keyvive	Capt. John Guy	Mr. Geo. Baker.

MARQUETTE & BESSEMER DOCK & NAVIGATION CO.

Vessel	Captain	Engineer
M. & B. No. 2	John Van Buskirk	J. J. Stevens.

CANADA ATLANTIC TRANSIT CO. OF U.S.

Vessel	Captain	Engineer
Arthur Orr	John Simons	D. E. Mance.
Kearsarge	H. Jaenke	Fred Welke.

ONTARIO CAR FERRY COMPANY, LTD.

Vessel	Captain	Engineer
Ontario, No. 1	S. McCaig	D. L. Smyth.
Ontario, No. 2	F. D. Forrest	J. Alan Nicoll.

DEPARTMENT OF MARINE AND FISHERIES.

Vessel	Captain	Engineer
Grenville	Richard Smith	James Leonard.
Lambton	Alex. Brown	J. M. Brechin.
Concretia	D. Mills	R. Mullins.
Scout	Cory Hart	Geo. Lessard.
Argenteuil	Thos. W. Weir	Alex. Drury.
Dollard	S. Sauvageau	Albert Carpentier.
Vercheres	Adolphe Marchand	H. Robitaille.
Shamrock	A. Toupin	N. Marchand.

CANADIAN TOWING AND WRECKING CO., LTD.

Vessel	Captain	Engineer
Tug Jas. Whalen	A. G. McKay	M. Cosgrove.
Tug Sarnia	Geo. Stitt	L. Williams.
Tug A. F. Bowman	W. Nuttall	
Tug A. B. Conmee	Not appointed	
Barge Empire	W. H. Wilson	
Barge Mary E. McLachlan	Not appointed	
Barge Coteau	Not appointed	

Calgary barbers have got behind the price of hair cut and boosted the hang thing up to 75 cents. And it wasn't so many years ago that we used to sing a little ditty about "Johnny, get your hair cut, 15 cents."

Some high-brow has been delivering a bit of an address on the "Educative Value of the Movies." Our most vivid memories are of scenes where the hero operated on the villain's neck with a meat axe, or where some person dropped a custard pie on Charlie Chaplin's jaw.

Almost every day in the week one hears of something that has taken another advance in price. No doubt we are in an era of high values, with everything steaming along under peak capacity. All will be well until some tinker comes along some day and breaks the peak off.

Howard Elliott, President of the Northern Pacific Railroad, is reported to have stated before the Association of Life Insurance Presidents at New York recently that United States railways need an equipment of $3,000,000,000, and that if provision is not made for developing railways continuously the cost of living, instead of being reduced, will go higher.

Eastern and Western Canada Marine Activities

MARCH CORRESPONDENCE

THE Port of Montreal is still shrouded with the mantle of winter, and nothing definite is known as to the possible date of the opening of navigation. There are, however, signs that indicate the near approach of the season's activities, in the gradual re-employment of the harbor workmen. Late last year about 400 employees were laid off, as is customary at the Port, but for the past month the winter staff has been gradually increased week by week, so that by the end of April the operations will again have assumed their early summer conditions. The ice in the River this year may possibly interfere with the early opening of the Port, but harbor officials are hopeful of getting started before the middle of April. The early work of the ice-breakers lower down the river has not been as effective as in former years, owing to the heavy ice, and to the fact that the Lady Grey has had to battle alone, the Montcalm having had to undergo considerable repairs at Halifax after her severe service in the Gulf. The Lady Grey is now making slow progress above Quebec, but the thick ice encountered makes the work very difficult. The rain and the wind of the past week has been of some assistance in weakening the ice, but the water level is gradually rising in the vicinity of the harbor. It is not anticipated that any serious flooding will take place as a consequence of ice conditions.

Plans are being made for the annual emptying of the Lachine Canal, preparatory to the regular cleaning and repairing. The water will start to run out on the 25th of this month, and the refilling will depend on the current weather conditions, and the extent of the repairs and other work required in connection with the undertaking. It is expected that the canal will be ready for service about the middle of April; last year the first passage was made on April the 18th.

Thomas Robb, manager and secretary of the Shipping Federation of Canada, has been appointed to the lighthouse board as representative of shipping interests in the Atlantic division.

Early in the month the steam barge Mary Ann W. owned by the Webster Coal Company of Quebec, was destroyed by fire at her winter moorings in Louise basin. The fire was fought with great difficulty owing to the extreme distance from the hydrants.

Towards the end of February, the new plate mill of the Dominion Steel Company, at Sydney, was formerly opened, and the first plates rolled were of excellent quality and conformed to the highest requirements of Lloyds, both as to measurements and physical analysis. The mill is now producing on a commercial basis.

Capt. R. C. Brown, for twenty-two years in the service of the Anchor-Donaldson Line, the last fifteen as captain in command of different vessels, has been appointed Deputy Port Warden for the Port of Montreal. He has had thirty-two years of sea service and is now in charge of the S. S. Cassandra. He will assume his new duties on the opening of navigation.

Plans are being laid by the Montreal Board of Trade for the purpose of taking some steps to have the proposed increase in wharfage rates reconsidered by the Government. It is expected that the opposition of the Board, in this connection, will lead to further developments, but the nature of these will depend on what action will be taken in the near future.

William Phillips, who for several years has been a director of the Robert Redford Company, has resigned to accept the position of European manager of the C. N. R. and the C. G. M. M., with headquarters in London. The duties of Mr. Phillips will not be entirely new to him, as he was, for several years, European manager of the C. N. R., so that he may be said to be returning to his former office in a duel capacity.

The pleasure steamer Empress, which has been making trips between Lachine and Carillon, and shooting the Lachine Rapids on the return trip for the past thirty years, is being taken off the route and sold. It is claimed that she is too big for this specific trip, requiring a crew of nineteen men. It is a paddle steamer, 185 feet in length, 27½ feet beam, and 8 feet draft, with a gross tonnage of 678 tons, and accommodation for 800 passengers.

Contracts for ten freight ships have been placed with the National Shipbuilding Corporation of Three Rivers, by three different French companies. Two steamers of 300 feet long have been ordered by La Compagnie de Navigation, Marseilles; four steamers of 380 feet in length by La Societe Maritime Francaise; and four steamers of 310 feet in length by La Societe de Gerance et d'Armament. It is understood that these vessels will be used as wine carriers, and as oil tankers. The National Shipbuilding Corporation has its head offices in the United States.

A scheme for changing the climate of the Atlantic seaboard has been mooted by a group of English engineers. The proposal, which is part of a project in the construction of a railway from Quebec to St. John's, Nfld., is the building of a dam of masonry across the Strait of Belle Isle, which would, in their opinion, alter the current on the Labrador coast, so that the Gulf Stream would come further inshore and thus affect the climate of the eastern portion of the country. (This appears to be a case of mental theorizing where little or no practical advantage would result).

The method of pooling the earnings of the Montreal pilots that was in force last year does not seem to have worked out satisfactorily owing to the variation in the actual work performed by each pilot. The division last year approximated $2,600 for each pilot, whereas the earnings for individual pilots showed a very wide range. One pilot with a record of seven trips, only earned about $325, while the average trip was $32 per man. Another pilot actually earned $3,600, and by the pooling system received only $2,600. Some different arrangement is planned for this season.

Early in the month the Dominion Coal Company's carrier Cape Breton went ashore on Scatterie Island during a heavy gale that had previously disabled her by breaking her rudder and propeller. After going ashore she broke amidships. The officers and crew succeeded in reaching the island, but the vessel will be a total loss. The severe storms during the month have resulted in great damage to coast shipping. A few days ago the British steamer Tewkesbury was cast ashore about four miles northwest of Cape Pine, Nfld., and in a short time was completely broken up. The vessel was of 2,740 tons. The crew were landed safely at Peters River.

A. E. Cook, assistant manager of the Elder-Dempster Line, and who has recently returned from a visit to the English office, in connection with trade developments, stated that West African merchants in London were quite favorably disposed to the company operating a direct freight service between Montreal and the West Coast of Africa. There is every possibility of maintaining a permanent service on this route provided Canadian manufacturers will furnish the right kind of goods and at a price that will compete with that of other countries. While the new service is inaugurated largely as an experiment the company is optimistic of a prosperous future.

At a recent meeting of the Halifax Board of Trade, McLurg, general manager of the Halifax Shipyards, stated that it was the intention of the company to place a floating dock in the harbor with a capacity up to 20,000 tons, and that representatives were now on the other side of the Atlantic in connection with acquiring the same. He further stated that it was the intention of the company to work the plant when completed, to its limit, and as far as docking rates were concerned, that no increase had been made in the same—the present charge of 25 cents per ton for the first day and 12½ cents for each succeeding day, having obtained in Halifax for some years.

The Davie Shipbuilding Company of Quebec, since the reorganization, has

resumed active shipbuilding operations. The new 5,100 ton steel steamer for the Canadian Government is now on the way to completion, and as soon as sufficient steel material can be obtained to insure uninterrupted operations, the keel for a new 8,300 ton steel vessel for the Canadian Government will be laid. The company is likewise engaged in some extensive repairs on a number of vessels including the putting of a vessel together that came down the Lakes in two parts last fall. Work at the Louise Docks is again progressing and the installation of machinery in the wooden vessels for the French Government is now under way. Additional work is the alterations between decks on three of the boats of the Canadian Government Merchant Marine.

In speaking before the Canadian Club in Ottawa a short time ago, on the work of the Government in connection with the operation of the railroads and ocean service, D. B. Hanna, president of the C. N. R., spoke on the agencies that are being established all over the world to develop trade. The Government, he said, was giving a great deal of thought to passenger service, and before very long his office would have something to say in this regard. The total program is to complete 65 ships with a gross tonnage of 385,000. Mr. Hanna was most enthusiastic and optimistic regarding the Government venture in taking over the railroads, but warned the cabinet to keep their hands off the managerial end. "While so far," he said, "there has been freedom from political interference, and it is understood that we must from time to time lay our plans before the members, action must rest with the directors and managers to carry out the work without either members of Parliament or Cabinet Ministers attempting to participate in a managerial capacity."

The success of the newly organized association of Shipbuilders and Engineers is practically assured, so much so, that there is a great possibility that Provincial branches of the associati will be formed this year. Capt. W. J. Gerrard, the secretary, has stated that the different shipbuilders and engineers are quite enthusiastic regarding the co-operative possibilities that will enable them to obtain support that would be next to impossible through individual effort. "Although the shipbuilding industry," stated Mr. Gerrard, "and those dependent upon it have established themselves, we are nevertheless passing through a critical stage, and if shipbuilding is to be made permanent it must be demonstrated to Parliament and to the public of this country, that this industry is one that must be encouraged and given every opportunity to thrive and expand. The association's persistence in pointing out to shipbuilders and engineers how valuable an organization it is, is bearing fruit, and the executive will meet in the course of a few days to outline plans and in all likelihood appoint one or more of its officers to consolidate the association in the different provinces.

From the address of Alexander Johnston, deputy Minister of Marine, given before the Ottawa branch of the Engineering Institute of Canada, early this month, it is interesting to note that shipbuilding operations in Canada at the present time compare favorably with other and more experienced shipbuilding countries. He quoted figures to prove that in spite of highest wages, steel ships were being built in Canada at practically the same price asked by English shipwrights and cheaper than in the United States. In commenting on the initiative of the Government in the building of cargo steamers, Mr. Johnston said: "We decided that if we were to provide the money we would build our own vessels, register them in this country, have them subject to our jurisdiction and thus get the maximum results from them. At the end of the present year," he said, "we hope to possess a respectable merchant marine and the tonnage will reach the highest point in its history." Instead of the country assuming a heavy financial burden the returns from the operation of these vessels will more than compensate for the outlay so far incurred.

BRITISH COLUMBIA

THE Federal Government has entered into an agreement with J. Coughlan & Sons, of Vancouver, for the building of a second-class graving dock at Vancouver under the terms of the Dockyard Subsidy Act. The dimensions of the Vancouver drydock will be: Length from causson top to head-wall, 700 feet; clear width to entrance at bottom, 110 feet; depth over sill at high water, 30 feet. The dock is therefore considerably larger than the standard dimensions of a second-class drydock. According to dispatches from Ottawa, an important consideration in granting the Coughlan application was the fact that the dock will be able to accommodate the largest vessels now in the transpacific trade.

The Canadian Government subsidy on docks of the second-class is four and one-half per cent. on a maximum of $2,500,000 for a period of thirty-five years, or $112,500 annually. The Government, therefore, by deciding on the Coughlan plan as against others submitted, saves annually $135,000, because the subsidy on first-class docks is five and one-half per cent. on a maximum of $4,500,000 for thirty-five years, or $247,000 annually. This saving represents at 5½ per cent. a capital investment of $3,254,000.

Building of the drydock in Vancouver will not interfere with the plans for the big drydock at Esquimalt, which will be owned and operated by the Federal Government. The Esquimalt project will be substantially larger than the mainland dock.

Definite announcement is expected within a few days concerning the reported acquisition by French interests of the Foundation Company's wooden shipyards in Victoria for the construction of forty or more wooden steamships or schooners. Captain E. V. Argon, representing the people back of the project, has made the statement that work will proceed as soon as the company's experts arrive from France. Captain Argon attempted to purchase from the Foundation Company the plant and equipment which it used in the building of twenty wooden steamers for the French Government, but an agreement as to price could not be reached and the deal fell through. He is now negotiating direct with the Provincial Government with a view to leasing the sites formerly occupied by the Foundation Company's yards, and it is understood that the transaction is practically closed.

It is expected that the capital for the Victoria Shipowners (B.C.), Ltd., will be raised within a few days. The company has been loaned 70 per cent. of the capital required for the building of four barquentines in Victoria for the lumber trade, and the remainder of the funds are being subscribed by the public, local business men holding the nucleus. During the last few days a squad of life underwriters have been canvassing the city in much the same fashion as was done in the Victory Loan campaigns and the drive has so far been successful.

The Vancouver Island Whaling Company, Ltd., with head office in Victoria, is the latest addition to the list of whaling enterprises operating in Canada. Its only competitor on the Pacific coast is the Consolidated Whaling Corporation, which also has its headquarters in Victoria. The authorized capital of the new concern is $600,000, and options have been taken on two steel steamers suitable for conversion into whalers, and the base of operations will be somewhere on Barkley Sound. The organizers of the company are: S. C. Ruck, former general manager of the Consolidated Whaling Corporation; W. N. Kelly, former superintending engineer of the same company, and C. E. Ruck, former manager of that company's Akutan plant. Oil will be the main product, with fertilizer as a side-line. Mr. S. C. Ruck has been associated with the whaling industry in Newfoundland and British Columbia for twenty-two years.

Establishment of a foreign trade or "free zone" area in Vancouver has been actively taken up by the Board of Trade in that city, and representations on the subject will probably be made to the Federal Government during the present session of the House. Victoria is also agitating for a free port area.

Twelve 11,000-ton steel steamships, forming the largest fleet ever operated in the intercoastal trade, will be placed on the route between New York and Seattle and British Columbia ports, via the Panama Canal, if the United States Inter-state Commerce Commission grants the application of the Isthmian Steamship Company for permission to use the canal. The Isthmian Steamship

Company is a subsidiary of the United States Steel Corporation, which also owns a small railroad. Under an act of Congress, no steamships owned by railroad interests are allowed to enter the intercoastal trade. Steel and steel products will probably form the bulk of the cargoes westward, and the vessels will return to New York laden with lumber, canned salmon and other Pacific coast products.

Regardless of the decision of the present hearing, the Isthmian Steamship Company will operate a number of its steamships in the foreign trade routes on the North Pacific. If an adverse decision is handed down by the commission preventing operation of the company's ships between two coasts of the United States, the company is free to send ships from New York to, say, Vancouver. After discharging in Vancouver, the ship could go to Seattle to load for a foreign port. The first of the fleet to go to Vancouver will be the Steelmaker, carrying sugar from Cuba. From Vancouver the vessel will go to Seattle and thence to San Francisco, shipping freight in both ports for London and Belfast. The Isthmian Company owns thirty-two new steel steamships and operates a number of chartered carriers.

Another application in the fight for possession of the Prince Rupert Drydock and Engineering Company has been presented to the Supreme Court for stay of proceedings pending an appeal. E. P. Davis, K.C., intends to appeal on behalf of the Newman Erb interests against the refusal of Mr. Justice Morrison to make an order amending the pleadings in the materials to be presented at the trial. The Manson interests are represented by E. C. Mayers.

Sir Walter Cassel, in the Exchequer Court recently, gave judgment involving a claim for a third of a million dollars against the Dominion Government, when he threw out the application filed in the name of Grant, Smith & Co., and MacDonnell, the British Columbia contractors who built the big breakwater at Victoria. This company sublet part of the contract, and, although the action was taken in its name, it was not directly interested in the outcome. The claim was for the sum of $292,110 for excavation and a further sum of $27,000 for filling. The entire claim was thrown out, Sir Walter finding that the resident engineer was in collusion with the contractors and that anything he certified should be set aside.

In addition to its programme for the construction of a number of large passenger ships for the trans-Pacific and European trade, the Nippon Yusen Kaisha, leading shipping company of Japan, contemplates the building of a fleet of sixty cargo-carriers. The N.Y.K. programme includes seven big passenger liners, and, as previously announced, three huge palatial passenger craft of 20,000 tons and a speed of twenty knots are planned for the Hongkong-Yokohama-Victoria and Seattle run.

According to reports emanating from Seattle, David Rodgers, Seattle shipbuilder, and interests said to represent Japanese capital, are pitted against each other in efforts to buy the Skinner & Eddy Yard No. 2, Seattle, from the Emergency Fleet Corporation. The alleged effort of Japanese to secure control of the plant has been brought to the notice of the United States Department of Justice, according to a message from Washington, D.C.

The Chicago, Milwaukee & St. Paul Railway will shortly re-establish a branch office in Victoria, as formerly. After an absence of two years, Fred O. Finn has returned to Victoria to take charge of the company's business here.

The Veteran Products Company, capitalized at $50,000, has been incorporated in Victoria for the manufacture of fish oil and fertilizer from the mud shark. Captain Percy Shadforth will head the company, whose personnel will be entirely composed of returned men. The plant, valued at $25,000, will be located at Parker Island, near Montagu Harbor, and thirty miles from Victoria. A feature of the operations of the new company will be the tanning of the skins of the mudshark for the manufacture of boots and shoes. The fins of the shark will be shipped to China, where they are in demand as an article of food.

The steamship Francis L. Skinner, formerly the German Cosmos liner Sesostris, which was salvaged off the Guatemala coast in 1916 by a syndicate including Captain W. F. Logan, salvage expert of Victoria, has been sold to the Oriental Navigation Company, of New York, by the Skinner & Eddy interests, of Seattle, who operated her in the transpacific trade for a considerable period after her recovery and restoration.

An exceptionally large derrick is being employed at the Philadelphia Navy Yard in the erection of a new 350-ton fitting-out crane. The highest part of the crane is 230 ft. above quay level, and yet the derrick, standing on the quay, can lift pieces on to any part of the crane and handle 40-ton loads. The jib of the derrick is 252 ft. long between centres, with an auxiliary 10-ton hoist 13 ft. further out. The mast of the derrick is 102 ft. high. A combination of steam and electric winches is employed and the whole derrick can easily be dismantled and reduced to such dimensions as to facilitate transport to a new site.

A new German optical glass, described in the "Chemical Trade Journal," is designed for colorless spectacles —instead of the usual colored ones— to give protection against ultra-violet rays. The merit of the glass is due to the discovery that a suitable mixture of rare earths in glass flux absorbs the harmful rays. Such earths as neodymium, erbium, serium, lanthanum and thorium may be used in varying combinations, and the protective glass shows objects in natural colors.

NOTICE TO MARINERS

No. 4 of 1920

[Pacific No. 1]

All bearings, unless otherwise noted, are true and are given from seaward in degrees from 0° (North) to 360°, measured clockwise, followed by the magnetic bearing in degrees in brackets, miles are nautical miles, heights are above high water of ordinary spring tides, and all depths are at low water of ordinary spring tides.

BRITISH COLUMBIA

(11) Vancouver Island — Victoria Harbor—Berens Island Light—Red Sector to be Removed

Former notice.—No. 21 (63) of 1915.

Date.—On or about 15th April, 1920.

Position. — West side of entrance to Victoria harbor. Lat. N. 48° 25′ 28″, long. W. 123° 23′ 32″.

Sector removed.—The red sector now showing over an arc of 15° from 347° (N. 38° 30′ W. mag.) through N. to 2° (N. 23° 30′ W. mag.) will be removed.

Berens Island light in line with the light on the outer end of Ogden Point breakwater clears the western extremity of Brotchie ledge.

N. to M. No. 4 (11) 21-2-20.

Variation in 1920.—25° 30′ E.

Authority.—Report from Agent, Department of Marine, Victoria.

Admiralty Charts. — Nos. 1897b, 576, 2840, 2689, 1911, 1917 and 2531.

Publication. — British Columbia Pilot, Vol. I, 1913, page 63.

Canadian List of Lights and Fog Signals, 1919.—No. 2277.

Departmental File.—No. 22277A.

BRITISH COLUMBIA

(12) Chatham Sound—Entrance to Prince Rupert Harbor—East Kinahan Island—Erratum in Position of Light

Former notice.—No. 79 (208) of 1919.

Correct position of light.—On northeast extreme of East Kinahan Island. Lat. N. 54° 12′ 45″, long. W. 130° 23′ 45″.

N. to M. No. 4 (12) 21-2-20.

Authority.—Departmental records.

Canadian Naval Charts.—Nos. 301 and 303.

Admiralty charts. — Nos. 3282, 2453, 1737, 1923A and 2430.

Publication. — British Columbia Pilot, Vol. II, 1913, page 94.

Canadian List of Lights and Fog Signals, 1919.—No. 2364.

Departmental File.—No. 22364C.

A. JOHNSTON, Deputy Minister

Department of Marine and Fisheries, Ottawa, Canada, Feb. 21, 1920.

Pilots, masters or others interested are earnestly requested to send information of dangers, changes in aids to navigation, notice of new shoals or channels, errors in publications, or any other facts affecting the navigation of Canadian waters to the Chief Engineer, Department of Marine and Fisheries, Ottawa, Canada. Such communications can be mailed free of Canadian postage.

PROGRESS IN NEW EQUIPMENT

There is Here Provided in Compact Form a Monthly Compendium of Shipbuilding and Marine Engineering Auxiliary Product Achievement

BARNES GANG DRILL

The Barnes Drill Co., Rockford, Ill., have placed on the market a 26 in. all geared gang drilling machine with sliding heads as shown:

This gang drill is built for heavy ordinary type duty work, having same capacity as regular box column type.

It has the strength and power of the ordinary 36 in. cone belt driven drill, and is more conveniently arranged for quick control.

There are no cone and inherent belts to shift or to slip.

It has eight changes each of geared speeds and of geared feeds on each spindle, all independent of each other and all under instant control of operator.

Each spindle is exceptionally large and double splined. Each sleeve has 14 in. travel and drift hole is below sleeve. Head and spindle are counter-balanced, the weight being suspended by roller bearing sheave wheel. The other sheaves are accessible to oil. Head is gibbed to column face, insuring perfect alignment, and is held at any point within the long travel by two quick-acting clamp screws. The head is raised and lowered easily and quickly by means of a crank pinion operating in a rack. An adjustable stop is supplied to clamp on column face so that sliding head may be instantly brought back to exactly the same place each time head is raised.

This machine will drive a 2 in. high speed twist drill at .041 in. feed per revolution of spindle or at the rate of 6½ in. per minute in cast iron, without the back gears.

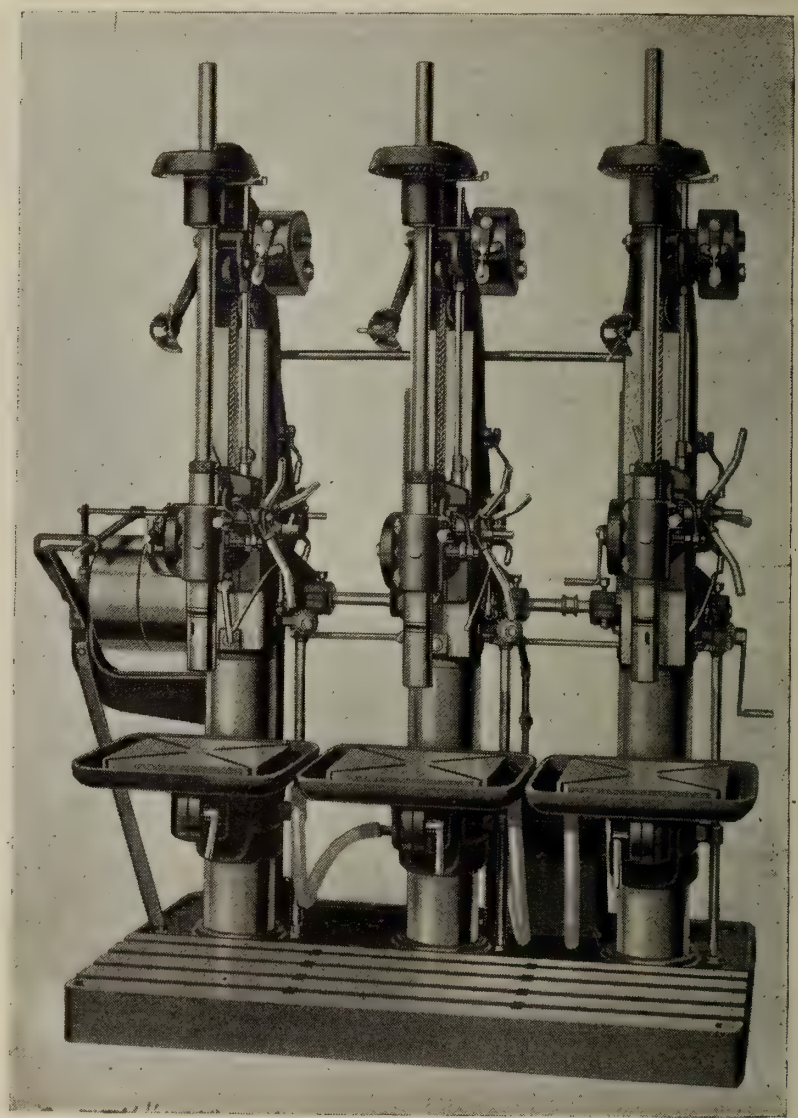
Suitable feeds are available for boring bar work and the machine will bore out an 8 in. hole.

The multiple disc friction clutch gears, giving reverse speed of 1¾ to 1, are on the driving shaft of the machine—not on the spindle—a strong point, as machine is geared down 13 to 1 in front of the clutch gears.

Any or all spindles can be made with ordinary type automatic reversing mechanism. Trip can be set so that the instant tap reaches depth required, spindle will automatically reverse, backing out at increased speed. Shifting lever can also be set so that when tripped automatically (or by hand) it will return to neutral position, thus stopping the spindle instantly instead of reversing same.

Following are the principal specifications:

	Inches
Height of drill	94
Distance from centre to centre of spindles	24
Distance from face of column head to centre of table	12
Distance from turned column to centre of table	13¼
Diameter of spindle nose	3 3/32
Diameter of spindles	1 15/16
Ratio of back gearing	4 to 1
Maximum distance from No. 4 taper spindle to table	40
Minimum distance from No. 4 taper spindle to base	18½
Maximum distance from No. 4 taper spindle to base	53½
Vertical travel of spindle for any position of head	14
Vertical travel of table	20
Vertical travel of sliding head	23
Diameter planed surface square table, exclusive of oil channel	18 x 18
Diameter of round table	23



GENERAL VIEW OF THE DRILL.

PORTABLE OIL BURNER

The Canadian Hauck Burner Co., Ltd., Port Hope, Canada, have placed on the market what is known as their combination Lead Melting Furnace and Portable Oil Burner.

This device is actually two outfits in one. When used as a melting furnace, 200 lbs. of lead or babbitt can be melted in 15 minutes and kept in a molten condition at the cost of a few cents per hour. Additional supply of fresh lead melts instantly.

When not used for melting lead in pot, the burner may be detached from the furnace and used for melting babbitt out of bearings, rebabbitting, bending pipes, straightening, preheating in

connection with welding, brazing, expanding to make shrink fits, etc.

The device consists of a furnace on three legs, supplied with 200-lb. capacity pot. The 12-gallon oil tank is of heavy steel, equipped with pressure gauge, hand pump and fittings. The burner is of the Hauck Hand Pump Type burning kerosene as fuel. Burner does not consume any air from the tank. The pressure secured by the use of the pump is simply to force the oil to the burner, where it is vaporized. A single pumping

HAUCK COMBINATION LEAD MELTING FURNACE AND PORTABLE OIL BURNER.

will operate the apparatus for three hours.

This device will, no doubt, interest anyone connected with the machine tool industry.

INTERESTING EXAMPLE OF PORTABLE DRILLS

An interesting photograph and drawing have recently come to our notice showing a very novel device in the plant of the Sterling Engine Co., Buffalo, N.Y.

The work consists in the drilling of diagonal oil holes in the cranks of four-cycle marine engines.

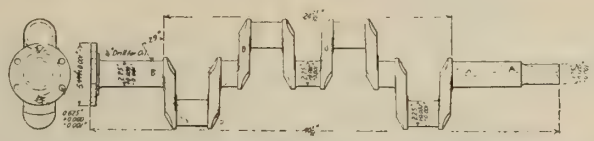
The photo shows the machine devised for this purpose and built in the Sterling Works, permitting of the use of standard Van Dorn portable electric drills.

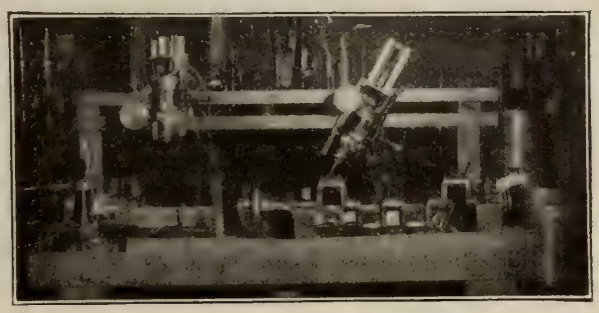
The table, or bed, is of cast iron planned and provided with a longitudinal slot in which the two V-blocks slide, their centres being in a line with the drill spindles. The two vertical members support the rail, on which are two carriages carrying the slides for the electric drills. The slides are arranged so that they will swivel in either direction. At the left-hand end of the table is a similar head for drilling the central oil hole A, Figure 2. The heads on the rail are used for the diagonal holes B in the crank webs.

Van Dorn portable electric drills are particularly well adapted for all kinds of general production purposes and quick repair work, as size for size they are the most powerful portable electric drills on the market.

The motor is hand-built in the plant of the Van Dorn Electric Tool Company, Cleveland, Ohio, on the same principle as the street car motor, but in miniature form, to meet the same kind of varying load conditions.

bushed bearings. The lead is counter balanced, and the bearings are fitted with a taper gib for taking up wear. The drive can be arranged for either belt or motor, the motor being geared to the drive shaft. Adjustable stop clutches are furnished which can be arranged to disengage at any portion of the stroke. Plain jaw clutches can be furnished if desired. The standard equipment consists of a complete punching and shearing outfit, including die holder, one die, one punch, coupling nuts, punch stem and stripper, shears and shear blocks.



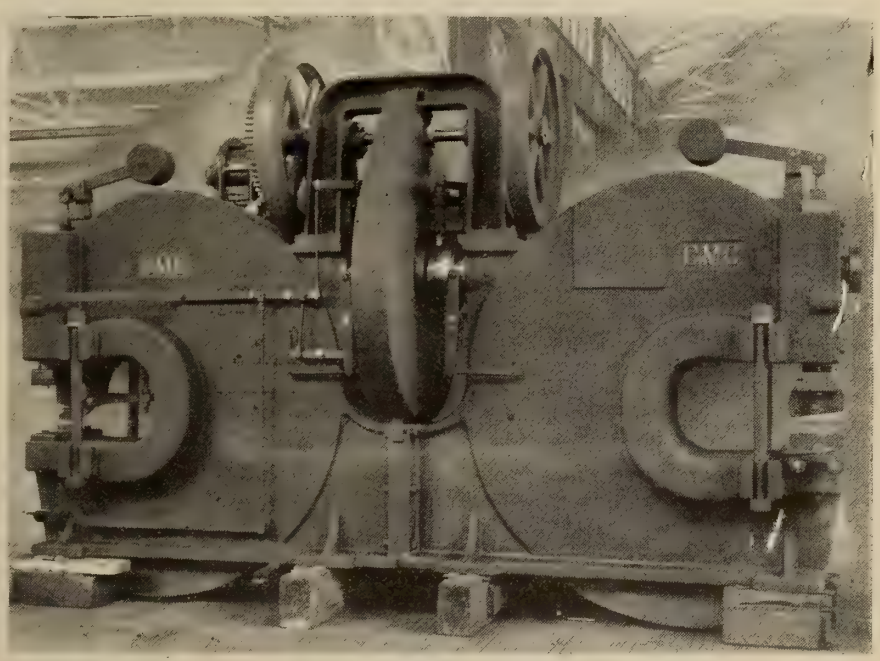


MACHINE USING PORTABLE DRILLS.

THE C. M. C. PUNCH AND SHEAR

The illustration herewith shows a punching and shearing machine, recently completed for the Canadian National Railway by the Canada Machinery Corporation of Galt, Ont. This machine is known as the No. 5 punching and shearing machine, and can be supplied with throat depths of from 12 inches to 60 inches. It is of very strong design, with ample bearing surfaces for the moving parts. The driving shaft is a steel forging, running in long bronze

Sault Ste. Marie.—Navigation at the Soo will open about the usual date, that is April 24th. Ice conditions are about the normal, as compared with the same date for the last twelve years. There are about 24 inches of ice at White Fish Bay, and the same at the Soo.



C.M.C. PUNCH AND SHEAR.

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IS THIS A REAL GRIEVANCE?

IN OUR January issue we had an editorial urging the need of training the men who are to be the future marine engineers. In connection with this we are in receipt of the following letter from a correspondent in Nova Scotia, which is of interest in presenting a point of view that may be shared by many more who do not give expression to it. The letter is as follows:

"I was interested to read your editorial in the January number regarding the length of service required for proficiency in the engineering profession or trade, whichever you might wish to term it. Canadian engineers can go to any part of the world and make good, but it is a deplorable fact that any position worth having in Canada has to be filled by someone imported from the other side. The Canadian Government is putting quite a fleet on the ocean and all good new ships, but they have apparently been unable to secure the services of Canadian engineers to man them or to take the executive positions such as superintendent or assistant superintendent engineer, and it seems to me to be grave injustice to men who have always lived in this country and contributed towards its support to be shunted to one side for men who have never paid a dollar in taxes in Canada and have no intention of doing so, with all due respect to their ability as engineers. I think that men could be found in Canada quite able to fill those positions and I would be glad to see your paper and every other paper in Canada take this matter up and try to have the condition rectified."

We are inclined to disagree with our correspondent as to being able to find men enough in Canada to fill all these positions. The fact must be faced that as far as marine engineering is concerned, there has been such a small amount of it done in Canada during pre-war years that there has been but little opportunity to train marine engineers. There is no use blinking the fact that when a shipowner is going to send a vessel costing $1,000,000 or over on a long voyage where they will be out of touch with the shore engineering department and management for months at a time, they must have men in charge of the engine room who are trained engineers. The training acquired by a man who started as a fireman and has worked up to be oiler and then engineer is not sufficient for this kind of work. Such men can be very successful operators on vessels engaged in short voyages, where in cases of emergency there is ample opportunity of skilled technical help, and a machine shop is never far away. Their knowledge and experience do not fit them to take the responsibility pertaining to the chief engineer of a vessel engaged in long ocean voyages.

The properly trained Canadian engineer will be as good as any other engineer, but the untrained man of any nationality cannot compete with the fully trained man. It takes a good many years to make a thoroughly competent marine engineer, and the sooner we recognize the fact the better it will be for the future of the Canadian merchant marine.

"LAFAYETTE, WE ARE HERE!"

We read in the French journal "La Journee" that what the American yards supplied to France was not ships, but "sabots"— wooden shoes. The French parliamentary merchant navy committee has received evidence according to which none of the 82 ships, including 40 schooners, built in the United States for the French Government at a cost of $80,000,000, is now in a fit state for navigation purposes, the wood used in their construction having been insufficiently seasoned.

Educational Items for Future Officers

A Series of Questions and Answers on Subjects Pertaining to Seamanship—Rule of the Road—The Use of the Chart—These Articles Will Appear Monthly

Ship's Business

I HAVE compiled and arranged, for the use of Mariners who are preparing themselves for a seaman's life on board ship, a series of articles on Ship's Business, on our Lakes or elsewhere, in the hope that it will prove useful to those who should require to extend their knowledge of Seamanship and Ship's Business, and these remarks are to present in a compact form, the explanations of some of the elementary information with what a practical seaman of even short experience may consider almost minuteness; at the same time, we must remember that proficiency in what is really skilled workmanship, amounting almost to an art, can only be gained by much practice and perseverance, and he should therefore gladly avail himself of any advice or help he may be able to obtain from his more experienced shipmates. May I say now the disasters of the late winters have attracted public attention to our merchant marine, and have led to many inquiries into the causes of the loss of life and property by shipwreck that seem to increase in number and consequence every year.

The press has been severe on our sailors, and in cases censuring his want of skill in unmeasured terms; in education he is certainly inferior, which can be accounted for by considering that in the larger towns there are many openings in business, and opportunities of getting forward, for an educated man, so that he is not encouraged to choose the life afloat for a profession.

Many of the recent losses have been more through want of experience than want of education. Many books have been written for the instruction of the mariner, and though read by the aspiring youth who looks forward to success in his vocation, the real wants seem overlooked.

It is often taken for granted that a man knows his duty after he has been engaged, if he does, it is after some years of experience, having only for his guide the customs of his predecessors, which he learns orally perhaps, at a time when his inefficiency is severely felt.

The seaman of modern times is as good as his predecessors. They may be ignorant of many things they no longer require, but they have improved in others, which is more than an equivalent for their ignorance.

There are few men who have duties more numerous than our sailors (Masters or Mates). To fill the situation well, a man must be something more than a mere seaman. He is so often thrown upon his own resources, that he has occasionally to be stevedore, carpenter, sail-maker, ropemaker and painter, and when we consider that he is supposed to be able to fill the place of the commander, should circumstances require it, we find him filling a much more important office than many of us imagine.

It is singular that men, when promoted, so soon forget the vexations and grievances they suffered while they filled the lower office and take so little trouble to help along the other fellow who has not had the experience.

Navigation

NAVIGATION is the art which instructs the sailor how to conduct a vessel over the wide and trackless ocean or lake from one port to another, with the greatest safety, and in the shortest possible time.

Navigation may be divided into two branches; viz.: Seamanship, comprehending the method of managing a vessel by disposing her sails, rudder, etc., so that she may move in any assigned course or direction the wind or the weather permit. Navigation proper, which comprehends those methods by which a sailor determines at any time the situation of his vessel, the course she is to be steered, and the distance she has to run, to gain her intended port or harbour. The requisites of a sailor, in order to understand this branch of the Nautical Art, are a complete knowledge of the figures of the earth, with the various imaginary circles drawn upon it, so as to be able to ascertain the distance and situation of places with respect to each other; the method of finding the ship's latitude and longitude, either by her course and distance run, or by astronomical observations, the use of various instruments, as the log, compass, log glass, quadrant, sextant and chronometer, etc., the different allowances necessary to be made in estimating a ship's way. as for leeway, the variation, and the deviation of the

compass and currents; the method of finding the time of high water at any place; the use of charts, with the method of constructing them, all of which particulars, depending on arithmetical and astronomical principles, I shall endeavor to explain and illustrate in such a manner as to render every part as clear, concise and methodical as possible.

Arithmetic of Navigation

It is, of course, supposed that all officers are well up in the four rules of arithmetic: addition, subtraction, multiplication and division—which are constantly required in navigation, as in daily business transactions.

Logarithms

Logarithms are a series of artificial numbers.

It should be known they were invented by Baron Napier for the purpose of shortening many of the calculations of common arithmetic.

PRACTICAL GEOMETRY—Sub head

From which we get our definitions, and geometry is the science which treats of extension, or form; that is extent of distance, extent of surface, and extent of capacity, or solid contents.

A solid is a magnitude which has length, breadth and thickness.

A surface is the boundary of a solid, and has length and breadth only.

A line is the boundary of a surface, and has length only.

A point is that which has no dimensions of any kind—neither length, nor breadth, nor thickness. It has position, but no magnitude, being the extremity of a line.

Sailings

Plane Sailing, Traverse Sailing, Parallel Sailing, Middle Latitude Sailing, Mercator's Sailing, and Globular or Great Circle Sailing, and there are others which are but modifications of those I have mentioned.

Parallel Sailing

Parallel sailing is the method of finding the distance between two places in the same latitude; when their difference of longtitude is known or otherwise; of finding the difference of longtitude corresponding to the meridian distance or departure made good when a vessel sails or steams due East or West.

Definitions

A straight line is that which lies evenly between its extreme points without changing its direction, and is the nearest distance between the two points that terminate it.

When the word "Line" is used, it is understood to be a *straight* line, as is generally expressed by two letters at its extremes.

A curved line is that which is continually changing its direction.

Parallel lines are such as extend in the same direction from each other, and which, if infinitely produced, would never meet.

A plane surface or plane, is that in which a straight line will wholly coincide when drawn between any two points on it.

Earth

The earth, consisting of land and water, is a body of globular form, flattened towards the Poles.

Definitions relating to the earth's axis:

Axis.—The axis of the earth is that diameter around which the earth daily revolves from West to East. The revolution is completed in 24 hours.

Poles.—The poles are the two ends of the diameter (or axis) around which the earth's daily revolution is performed. The pole which is nearest to us, in Canada, is called the North Pole, and the other is the South Pole, and as the Poles are the ends of a diameter they are 180 degrees apart.

Equator.—The equator is a great circle on the earth equally distant from the two poles. It divides the earth into two equal parts, and they are called Hemispheres.

Latitude.—The distance of a place from the equator measured (in degrees and parts of a degree) on the meridian of that place, is its latitude.

As latitude begins at the equator where it is 0 degrees, so it ends at the poles where it is greatest, or 90 degrees.

Latitude is North when the place is situated in the North Hemisphere, and South, when it is situated in the Southern Hemisphere.

Longitude.—The longitude of any place on the earth's surface, is expressed as an arc of the equator contained between the meridian and passing through that place and the first meridian, whence longitude is reckoned to begin. Longtitude, like latitude, is estimated in degrees and parts of a degree, and may be Eastward or Westward.

The horizon of any place is that apparent circle which limits or bounds the view of a spectator on the water, the eye being always supposed in the centre of the horizon. This circle is divided into parts similar to the divisons on the mariner's compass.

Logs

These are the instruments used in navigation for estimating a vessel's track and position at sea, and each requires a special description.

The common log consists of a log ship and log line.

The ground log—an adaptation of the common log is used in shoal water when the vessel is drifting in a tideway or amidst currents, with no land visible, or no distant object visible to fix the position. A load four or five pounds is made fast to a log line and then cast overboard; thus the lead rests of the bottom, and the rate and drift are indicated, irrespective of current, and can be noted as usual, especially will this log show the drift of the current as it is hauled in.

The patent log we know.

Compass

When out of the sight of land, the compass is the only instrument that shows in which direction the vessel is heading; it is therefore necessary to understand its construction and use—together with the corrections which must be applied to its indication.

In the first place, you must learn the dimensions of the compass card, and then how to *box* the compass; that is, to be able to repeat the points in their order, commencing at any given point, and going to right or left.

Divisions of the compass card:

The compass card is a circle, divided into 32 equal parts; called points of the compass; and standing on the deck of a vessel at sea, you must always suppose yourself to be in the centre of such a circle, the circumference of which is the visible horizon and towards some point of which the vessel's head is divided. One end of the meridianical line is named North, because the line trends in direction towards the pole of that name, and

---

A practical demonstration of wireless telephony was recently made before a meeting of the Montreal Rotary Club, when A. H. Morse, of the Marconi Company of Canada, gave a short address on this subject and provided the opportunity for the members present to listen to the sounds transmitted from a sending instrument located over a quarter of a mile away and in one of the noisy parts of the city. Mr. Morse pointed out that the wireless telephone has obviously very wide application, but that there was no present indication of its being developed to supplant the ordinary city phone. There was little need for it for such use, but for long distance work, as from city to city and over greater distances than were practicable for wires, it would eventually be of great benefit.

Collingwood.—Through the efforts of Capt. W. Inkster, Government examiner of masters and mates on the Great Lakes, a number of steamship operators had a meeting with representatives of the Canadian Merchant Service Guild, and expressed a desire to co-operate with the Guild. With reference to the pay of steamship officers, the Guild promised to submit a schedule at the conference to be held next January. It was decided that two conferences should be held annually between the Guild and the operators.

Newfoundland to Greece in 23 Days

This is the record of the auxiliary Schooner "Samuel Courtney" and Mr. S. Courtney, her master, attributes it to her

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Auxiliary Motor Schooner "Samuel Courtney," 1918, equipped with 2-100 H.P. Fairbanks-Morse type "C.O." Semi-Diesel Crude Oil Engines.

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MARINE NEWS FROM EVERY SOURCE

Port Huron.—The tug "Sport" has broken the ice in the Black River, giving full outlet to the water. The steamer H. K. Oakes is now unloading at the Grand Trunk elevator. The steamer "Stadacona" has commenced her outfitting.

Collingwood.—The death occurred in Meaford recently of Mr. William Jamieson, in his 72nd year. Mr. Jamieson was the first purser of the steamer Favorite, of the Meaford Steamship Company. He held the position until the boat was sold. Mr. Jamieson was born near Peterborough, going to Meaford as a young man.

Montreal.—Contracts for ten freight ships have been placed with the National Shipbuilding Corporation, Three Rivers, by three different French companies. It is understood that these ships will be used as wine carrying vessels and as oil tankers. The National Shipbuilding Corporation has its head office in the United States.

Brockville. — The American barge "Arthur," recently purchased by the Webster Steamship Co., of Quebec, from John O'Hagan, of North Tonawanda, has been transferred to the Sincennes McNaughton Co., in exchange for the barge "Valencia." The Sincennes McNaughton Co. have also purchased the barge "Nellie Reddington" from the Canada Steamships Lines.

Ottawa.—According to a statement by Mr. Hanna, head of the National Railways, ships built in Canada are only the same price as those built in Great Britain, and cheaper than those built in the United States. The latest Government contracts were placed in Canada at $163 per ton. If the exchange handicap could be adjusted, Canadian shipyards should be able to secure foreign orders.

Cleveland. — The engineers of the Pittsburgh Steamship Company will join their ships April 5, and the work of fitting out the bulk freighters of the lakes will start early in April. A good number of these vessels will be ready by the middle of the month. Most of the vessels that are at the head of the lakes unchartered will go for ore to begin the season's work.

Atlantic Rates Increased.—There has been a further increase in both passenger and freight rates on the North Atlantic, according to an announcement from New York. The rate on foodstuffs has been increased from 45 to 75 cents per 100 lbs. Passenger fares have been increased 13½ per cent., making a total increase since July last of thirty-three and one-third per cent.

Shipbuilding Company Reorganized.—The Davie Shipbuilding Company of Lauzon, Que., has just undergone a reorganization and will now proceed on the completion of the contracts in hand. These include the balance of the wooden steamers for the French Government. The new president is Mr. J. W. Norcross, of the Canada Steamship Lines, Major General Sir David Watson, vice-president, and Mr. George Davie as general manager.

Collingwood.—The annual meeting of the Collingwood Shipbuilding Co. took place recently, and the general statement for the past year was received with satisfaction. Capt. Alex. McDougall resigned from the Board of Directors, and is succeeded by Mr. John S. Leitch. The full Board is as follows: H. B. Smith, S. Dyment, J. W. Norcross, R. M. Wolvin, H. W. Cowan, F. S. Izard, and J. S. Leitch.

Cleveland.—There will be no coal cargoes before the middle of May. The coal handling equipment will be ready by April 11, but the local demand is so great that no coal will be loaded in steamers till they are ready to start. Many ports will want early coal shipments, and some of the coal docks are swept clean. There is no change in the grain freight market, and a number of ships that have been on offer for some time have not been placed.

Ottawa.—Mr. R. A. Willard, of the Marine and Fishery Department, does not despair of an early opening for navigation. He claims that Easter being early this year means that navigation will also be early. The tidal effects of the new moon will soon clear the St. Lawrence of ice, he believes. The "Shamrock" and the "Dollard," which have been wintering at Sorel, are being put in commission, and will be ready for buoy-laying April 15.

London.—The "Imperator" recently acquired by the Cunard Line from the German owners, had a very unpleasant experience on her last voyage. The vessel suddenly took a very sharp list, during a concert in the big saloon, and the 600 passengers were thrown from their seats. Fortunately, there was no panic. The cause of the occurrence is not yet known, but was evidently due to trouble in the engine room. The sailing scheduled for March 27 to New York was cancelled, but no reason given.

Navigation Some Time Off.—Although last year the first steamer crossed the lake on March 6th, this year at the present date the harbor is ice-bound, and it will be about three weeks before navigation opens. The Canada Steamship Lines are actively getting their vessels ready for the opening, and have an army of painters at work on them. This year the hulls will all be painted white instead of the dark color of former years. The new vessel projected for the line will be put on the lake as soon as she can be procured, but the company are not saying much about this at present.

Victoria Dock Case Judgment.—The case of Grant Smith & Co. and McDonnel, Ltd., against H.M. the King, in connection with excavation work done on the dock at Victoria, B.C., by the plaintiff, has been settled by Sir Walter Cassells, in the Exchequer Court of Canada. The claims were for $333,812. The amount of excavation work was admitted, but the Department of Public Works claimed that rock prices had been charged for material which should have come under a lower classification. The court found that the resident engineer was in collusion with the contractors, and work certified by him should be set aside. The entire claim was thrown out.

MOTOR LIFEBOATS FOR THE ROYAL NATIONAL LIFEBOAT INSTITUTION

The Royal National Lifeboat Institution has placed an order with Messrs. J. Samuel White & Co., Ltd., East Cowes, Isle of Wight, for twelve new motor lifeboats. They have been allocated as follows: Norfolk and Suffolk type (46½ ft. x 12 ft. 9 in.), to Cromer; Watson type (45 ft. x 12 ft. 6 in.), to Penlee, The Mumbles, Dunmore East, and Youghal; Watson type (40 ft. x 11 ft.), to Barry Dock and Tenby; Self Righting type (40 ft. x 10 ft. 6 in.), to Brixham, Selsey and Bembridge; and Self Righting type (38 ft. x 9 ft. 9 in.), to Sennen Cove and Appledore. The firm's unique reputation as designers and builders of lifeboats has been sustained through a period of upwards of 80 years, and commenced with the world-wide recognition of the late Mr. John White's inventive genius in designing and building this special type of craft.

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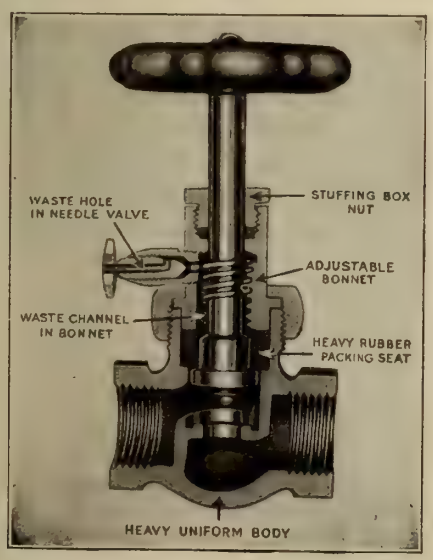
FIRST—the adjustable bonnet which allows the needle waste valve to be placed in proper position for catching waste water.



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Trade Gossip

Montreal.—The National Shipbuilding Company of Three Rivers have received contracts for ten cargo carrying steamers from French interests. The purchasers represent three different interests. The vessels will be used as wine carriers and oil tankers.

Big Locomotive Order.—The Canadian National Railways have placed some big orders for locomotives lately. These include 25 Sante Fe engines, weighing 320,000 pounds; 32 Pacific type weighing 261,000 pounds, and 10 Pacific type weighing 271,000 pounds.

Compensation Act Revised.—The Legislature of Manitoba is considering a bill, introduced by Attorney-General Johnson, to alter the bill of 1916 dealing with workmen's compensation. The measure will increase the amount and incorporate the system of state insurance.

Coal Prospect Better.—Industries in Hamilton have been put to a great deal of inconvenience during the past two months, due to shortage of coal. The coming of the mild weather is expected to alleviate this considerably, and another week should see the worst of the shortage over.

The Department of Public Works is calling for tenders, up to March 12, for the construction of a breakwater protection for Toronto Island. Plans and specifications can be obtained at the office of the Department, Ottawa; the office of the District Engineers, Equity Building, Toronto; and the Shaughnessy Building, Montreal.

New Line to Sarnia.—The Chamber of Commerce of Sarnia is anticipating a visit from President Beatty and officials of the C.P.R., who will look over the ground, with a view to putting in a line from London to Sarnia. The City Council state that if the line is put in, at least twenty industries will locate along the bank of the St. Clair River.

Extending Business. — The National Shipbuilding Co. of Goderich have extended their foundry, which consisted of 2,000 square feet of floor space, with a 52 in. cupola, to 14,000 square feet, with another 36 in. cupola. The firm have also installed several modern power moulding machines and are carrying on general foundry practice for both job and production work.

Freight Payments to U.S.—There will be a hearing on March 16th, at Ottawa, before the Railway Board, re the payment of freights on goods originating in Canada and intended for U.S. points. The railways have ordered their agents not to accept prepayment on this class of goods, claiming that, owing to the exchange rate, they lose money on the American portion of the run.

Not Selling Out.—The Dominion Foundries & Steel Co., of Hamilton, held its annual meeting. The directors and officers were all re-elected. C. W. Sherman is president and A. G. Wright secretary. Mr. Wright stated that the business was purely routine and no mention was made of any dividends. Mr. Wright denied that the company was contemplating turning over the plant to the American Foundries, Ltd. Earnings of $634,000 were reported.

Nova Scotia Industries. — The total production of the Province of Nova Scotia including industries, commerce, agriculture and fisheries had a value for the year 1919 of $198,000,000, which is nearly $300 per capita. The production of lumber showed an increase of 100 per cent. over last year, and was valued at $10,000,000. The total crop of apples amounted to 1,000,000, of which 300,000 were exported to Great Britain and the United States.

Paris Engineering Works.—The Geo. W. McFarlane Engineering Works, at Paris Station, is expected to be shortly in operation, and will soon be employing upwards of 100 skilled mechanics. The Town Council have taken up the request of Mr. McFarlane, and will undertake to erect suitable housing accommodation for the workmen. The financing will be done under the Enabling Act of the Province, whereby the local Government guarantees the amount.

Held Banquet.—The first annual banquet of the men of the electrical department, Steel Company of Canada, at Hamilton, was held with 75 of the day men present. At 8.30 p.m. the men were invited to the banquet table to partake of the good things provided. After every person had satisfied the inner man, the boys were treated to an unique programme supplied by themselves. E. S. Jefferies, electrical engineer, and Mr. Simpson, sales manager, both delivered addresses, which were very much enjoyed by all those present.

Canadian Firm Opens in States.—The Pressed Metal Company have nearly completed their factory at Marysville, just south of Port Huron, Mich. The equipment will be moved in April and production start about May. The company will manufacture bushings for the Ford Motor Co., and their output will be 100,000 bushings a day. The Wills Lee Company have bought land on both the Canadian and American side of the St. Clair River, and industrial expansion on the Canadian side is expected to follow closely that on the American.

According to the "Rio Times," the total hydraulic power available in Brazil amounts to nearly 6,728,000 horse-power, or about 5,000,000 kilowatts. Among the principal sources of this potential power are the following falls: Guahyra Fall, 1,058,400 kilowatts; Paulo Affonso Fall, 1,031,940 kilowatts; Umbupunga Fall, 328,545 kilowatts; Santa Maria Fall, 191,100 kilowatts; Itapuca Fall, 41,215 kilowatts; Avanhandava Fall, 45,276 kilowatts; Lavrinhas Fall, 38,005 kilowatts; Salto Grande Fall, 17,785 kilowatts.

Orders From Japan.—A large order for rods and bars has been secured from the Japanese Government by the Dominion Steel Corporation which will keep the rod and bar mill in operation for several years. Such was the information handed out at the mills. The mill has been out of commission for seven or eight months but workmen are now busy making necessary repairs and adjustments to the mill, and it is expected that rolling of the new order will be started early next week. A considerable number of men will be given employment by the operation of the mill.

Following the reorganization of the Davie Shipbuilding Company at Quebec, considerable increased activities are taking place at the plant. Work on the 5,100-ton Canadian Government steamer is progressing rapidly, and as soon as sufficient steel can be obtained to insure uninterrupted operations, the keel for a new 8,300-ton steamer will be laid. The repair work in hand is also of considerable volume, and about 1,200 men are steadily employed at this yard. The Louise Docks are taking on a more active appearance and immediate steps are to be taken to complete the wooden steamers recently built for the French Government.

Among the prizes proposed by the Paris Academy of Sciences for 1921 are: The Montyon prize—700f.—for the invention or improvement of instruments useful to the progress of the mechanical arts; the Henri de Parville prize—1,500f.—for original work in mechanics; the Pierson-Perrin prize—5,000f.—for a discovery in mechanics; the Plumey prize—4,000f.—for improvement in steam engines or any other invention contributing to the progress of steam navigation; the Gaston Plante prize—3,000f.—for the author of a discovery, invention, or work important in the domain of electricity.

U.S. Has Claim.—A claim has been filed by Sidney S. Underwood, representing the United States, for $376,496 and $100,000 damages, against Motor Trucks, Ltd., Brantford. After adjusting its claims with the Imperial Munition Board, the company were awarded $1,633,203, and after various deductions, the amount owing to the company by the United States was $637,812. This was paid, together with an additional $5,000 by the U.S. Government, on November 10th. The U.S. now claim that the value of the lands and buildings making up the company's plant at Brantford were included in the payment, and that the company now refuses to hand over the property to the United States.

Work Progressing.—Developments at the plant of the Dominion Iron and Steel Company at Sydney are steadily progressing from day to day. Up to the present but two of the six blast furnaces have been in operation. A third furnace is now being heated preparatory to relighting and operation. This of course is a section of the works which necessarily always was on double shift, and the prospect of the blowing in of all the remaining furnaces in the immediate future

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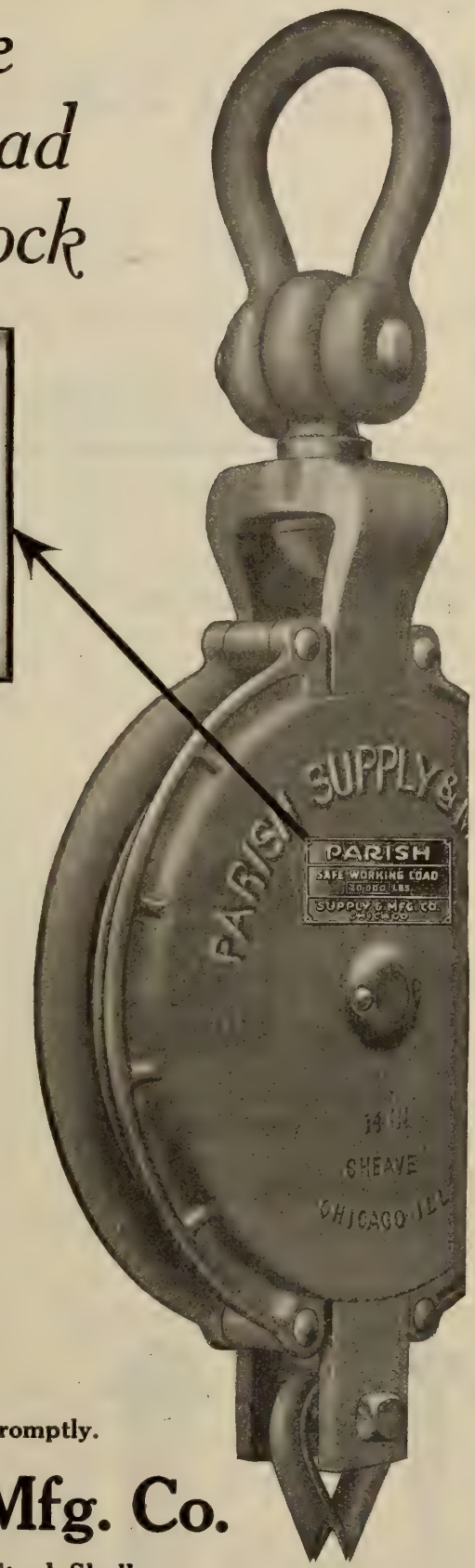

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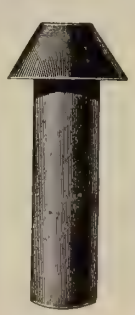

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BOOK REVIEWS

"Smooth-On Home Repairs" is the title of a valuable booklet just published by the Smooth-On Manufacturing Co. In this book has been explained just how to repair leaks in boilers, stove pipes, radiators, furnaces, tanks, and the many other household fixtures that need attention from time to time. There are from thirty to forty different kinds of repairs with the remedy illustrated and explained.

Automobile repairs also receive attention in this book. Cracked water jackets, leaky radiators, scored cylinders, etc., are taken up, and their repairs explained.

A copy of this book will be sent free on request to the Smooth-On Manufacturing Co., Jersey City, N.J.

The Wheeler Condenser & Engineering Co., Carteret, N.J., announce the publication of the 1920 edition of their popular "Steam Tables for Condenser Work." This is the fifth edition. Every engineer who deals with the condensation or evaporation of steam should have one of these handy tables. The pressures below atmosphere have been especially calculated for this book by Prof. Marks.

The book gives the properties of saturated steam from 29.8 in. vacuum to atmospheric pressure in increments of tenths of an inch. The vacuum in inches of mercury is referred to a 30 in. barometer. This method is of course superior to the old method of giving absolute pressures in pounds per square inch, since it is customary to read vacuum i inches of mercury.

A complete table is also given of th properties of saturated steam above at mospheric pressure.

The book tells how to make measure ments by means of the mercury colum and barometer. It gives constants an tables for making corrections. It give the correction to be made for relativ expansion of mercury and brass scal etc. It is a very handy book and of size that can be carried in the pocket.

The Weekly Metergram is a new pub lication, published in the interests o the World Trade Club in advocacy o "Meter-Liter-Gram."

The Number 1 issue of Volume 1 wa published on January 15, 1920, and i well written and contains the subje matter of what the World Trade Clu stands for, the mill, cent, dime an dollar being the bases of a very goo argument.

Meter for length, Liter for hulk, Gra for weight is the foundation of th scheme which they propose to urge th world to accept as a world's standard o weights and measures, and the argu ments would seem to have good ground on which to build.

Among the advocates of the new sys tem is Gen. John J. Pershing, who wa commander of the American Army i France.

The death is announced from Smith Falls, Ontario, of Mr. Wm. H. Fros president of the Smiths Falls Malleab Castings Co., Ltd. Mr. Frost started th business in the year 1878, in a ver modest way, and gradually built it u until it became one of the largest ma leable casting industries in the provinc The deceased gentleman, who was 7 years old, played an active part in th life of the community, having served a mayor.

OPPORTUNITIES

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PERSONAL

A. B. White, recently chief engineer of the Dominion Shipbuilding Co., Toronto, and Capt. C. E. Henderson, (M.C.), have opened offices in Huron Chambers, Sudbury, where they will carry on an engineering and agency business, for engineering and manufacturing companies in Canada. Their lines will include mechanical and electrical machinery, especially catering to the mining and lumbering interests of the North.

The death occurred at his home, 20 Thorold street, of Mr. Orange Jull, the inventor of the only two mechanical snow plows now in actual use on railroads. Mr. Jull was a native of Trafalgar, Ont., where he was born 75 years ago. His first plow, the "Rotary," was made by the Polson Iron Works; the later invention, known as the "Jull Centrifugal," being built by the Rogers Locomotive Works, New Jersey. Mr. Jull leaves a widow and three daughters.

Directors of The Whitman & Barnes Manufacturing Company, following the annual meeting at the general office in Akron, Ohio, March 3rd, elected Mr. W. J. Elliott, manager of the St. Catharines, Ont., factory, a vice-president. Mr. Elliott will be in entire charge of the Canadian division of the company's business—selling and manufacturing. Twenty-seven years ago he entered the employment of Whitman & Barnes, in a minor position. Advancement from one position of importance and responsibility followed rapidly, when in January, 1908, he was made manager. His promotion to the official circle of the company is merited recognition of his excellent services and the confidence in which he is held by the corporation.

OPPORTUNITIES

The Power Plant Company, Limited, of West Drayton, Middlesex, England, are beneficial owners of the following American and Canadian patents and pending applications:—

United States Patent 1306653 for Power Transmission Toothed Gearing.
United States Patent 1323120 for Cutting Double Helical Teeth in Gear Wheels.
United States Patent 1325459 for Improvements in Thrust or Collar Bearings.
Pending Application U.S. Serial No. 248639 for Power Transmission Toothed Gearing.
Canadian Patent 161863 for Gearing.
Canadian Patent 192099 for Cutting Double Helical Teeth in Gear Wheels.
Canadian Patent 194629 for Power Transmission Toothed Gearing.
Pending Application Serial No. 225125 for Power Transmission Toothed Gearing.
Pending Application Serial No. 226126 for "Improvements in Thrust or Collar Bearings."

The Company is desirous of entering into negotiations either for the sale of the patents outright or for their exploitation by grant of Licenses and would be glad to receive enquiries in respect thereof.

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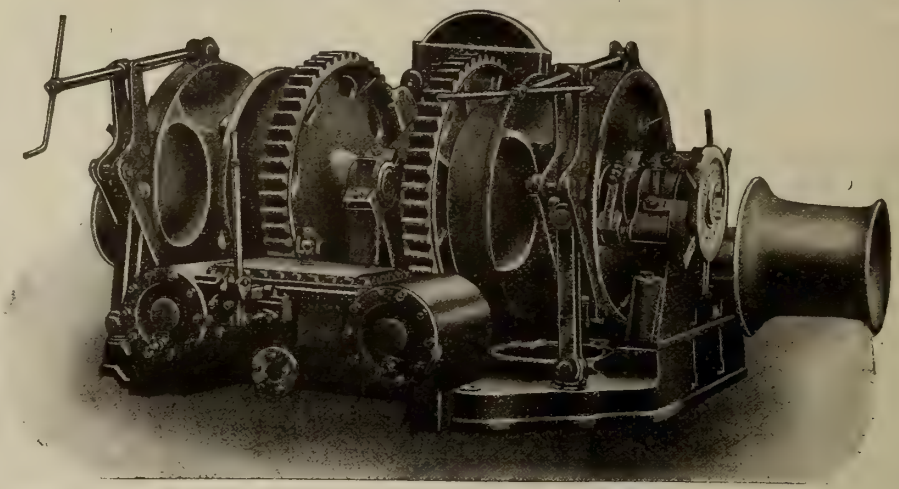

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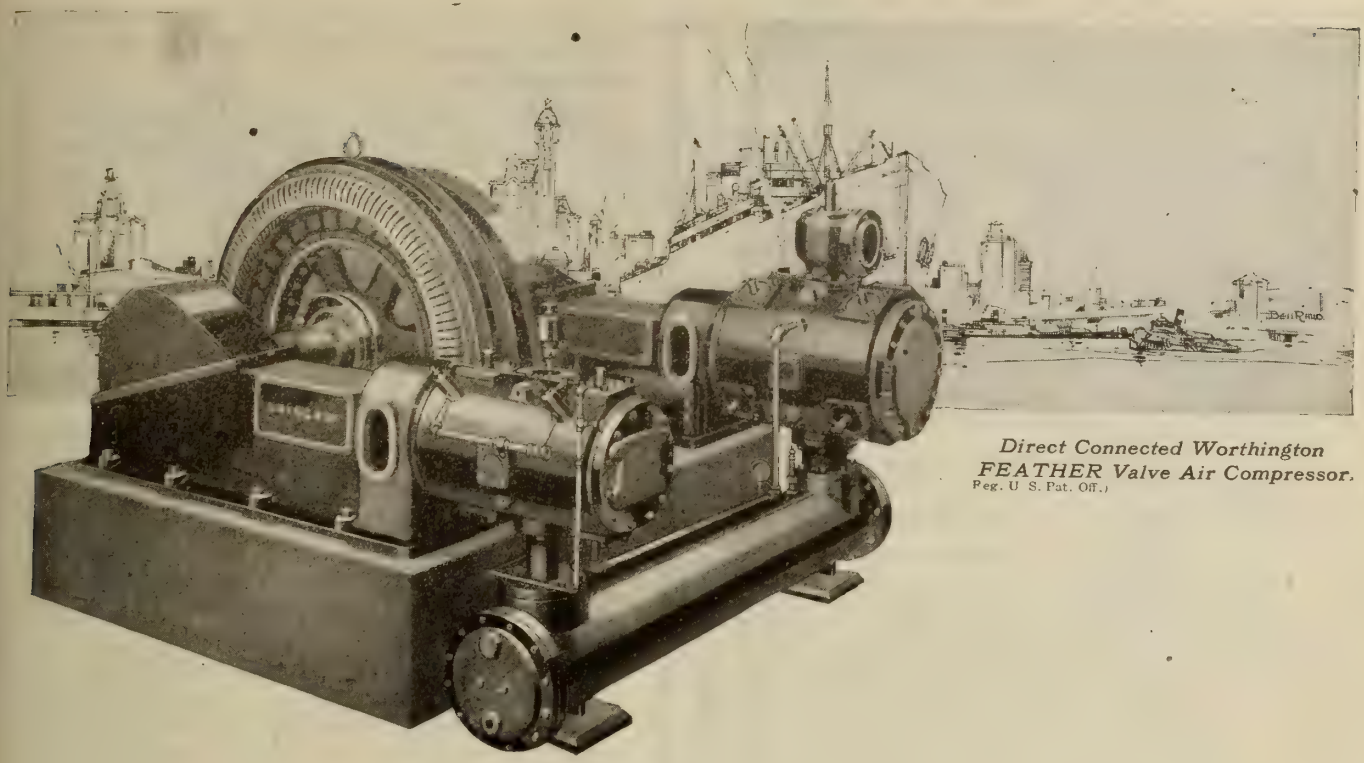

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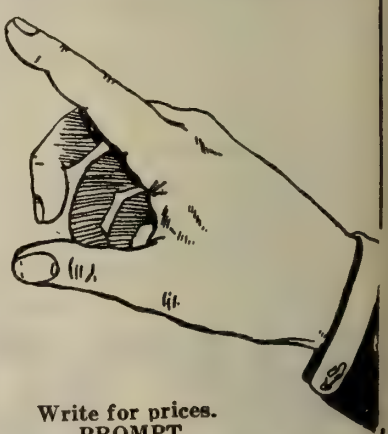

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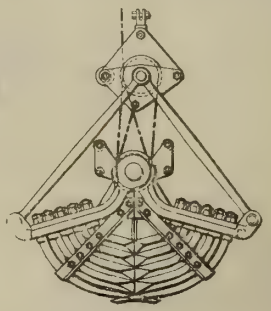

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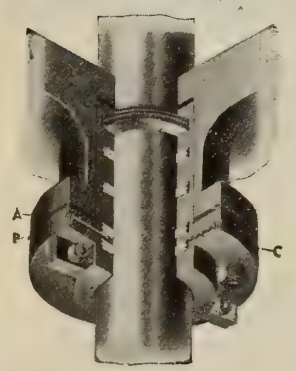

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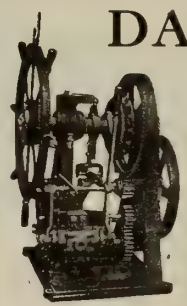

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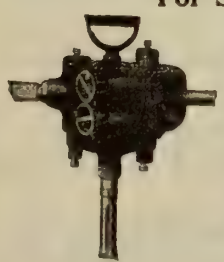

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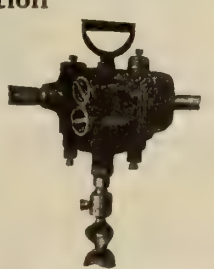

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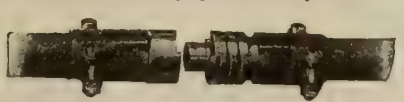
AIR  TIGHT

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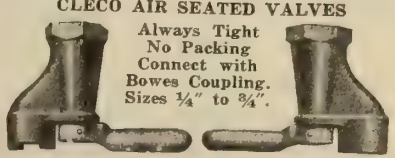

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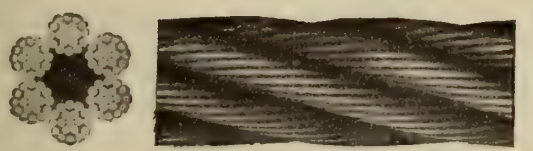

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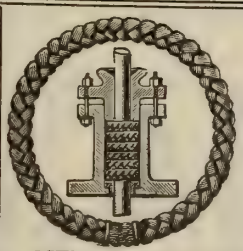

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Will Sir Thomas White shortly slip into the place of Sir Robert Borden and keep the Unionist Government in power until 1923?

These are predictions that J. K. Munro makes in the course of a witty, informative article on the political situation in the April 1st issue of MACLEAN'S MAGAZINE. J. K. Munro is writing the best political articles appearing in the whole of Canada.

Are we Playing into Germany's Hands?

"IF GREAT BRITAIN and the United States drift into subconscious antagonism now, Germany will have won in peace what she could not win in war," writes Agnes C. Laut in April 1st MACLEAN'S. She declares emphatically that for Canadians to create ill-will with the American people would be playing German's game in addition to losing—

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Miss Laut is saying things that will run contrary to the ideas of many people, but it is all the more worth while reading.

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In this issue will also be found the first instalment of a powerful and cleverly written new novel by a young Canadian author, Arthur Beverley Baxter. Do not miss "The Parts Men Play."

EIGHT MONTHS ADRIFT IN THE ARCTIC

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"The Wistaria Arbor"— a short story. By Robert W. Chambers.

"Storm Along, John!"— a lacrosse story. By C. W. Stephens.

"Gentlemen of the Long Robe"— an article on the legal profession in Canada. By the Honourable W. R. Riddell.

"The Thread of Flame"— a powerful novel. By Basil King.

One Hundred Magazines in One

All magazines and periodicals published are read carefully and the best articles found are reprinted in part in the Review of Reviews section of MACLEAN'S. Here are a few found in this issue:

The Strangest Tale of the War
The Red Hand Reaches Far East
The Triangle in the Pacific
The Rising Tide in Japan
Was Mrs. Wilson the Real President?
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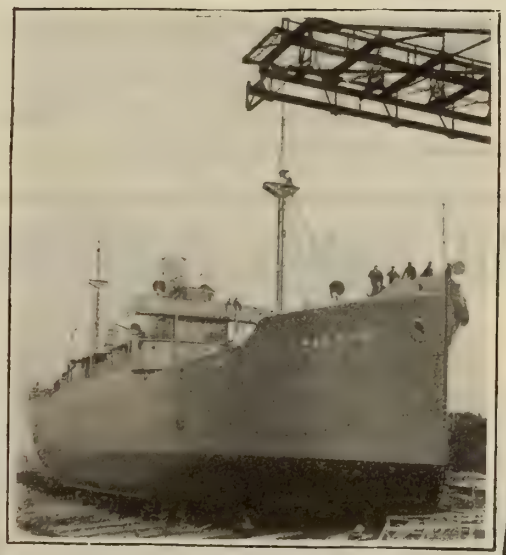

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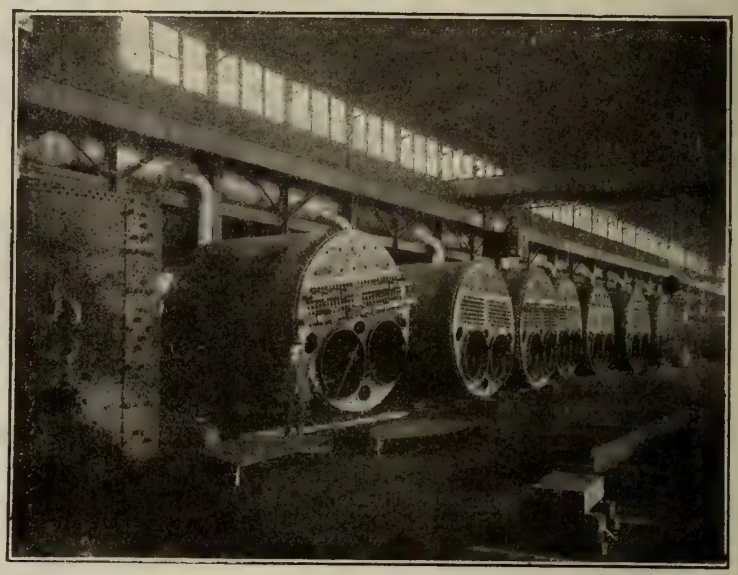

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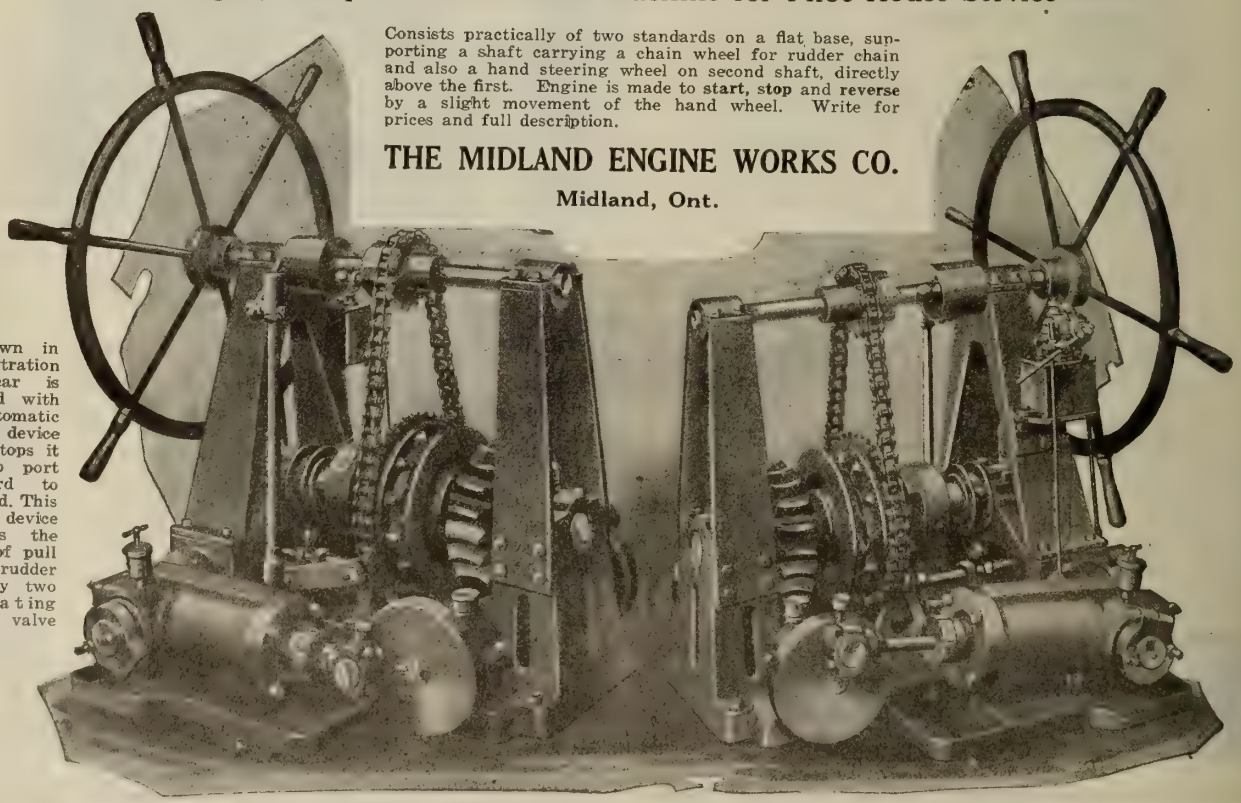

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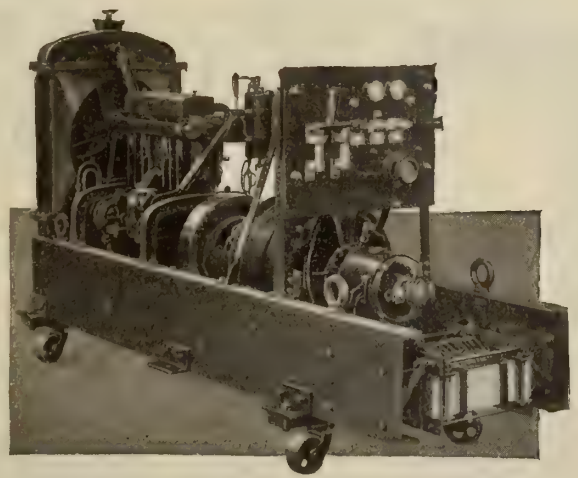

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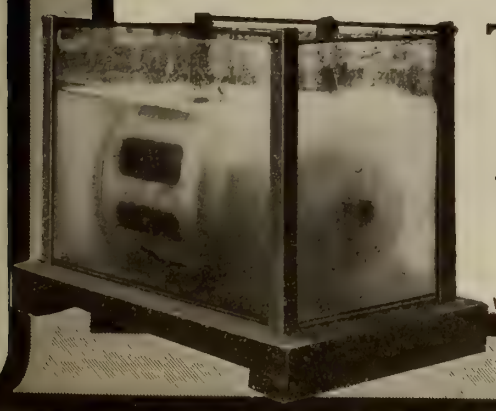

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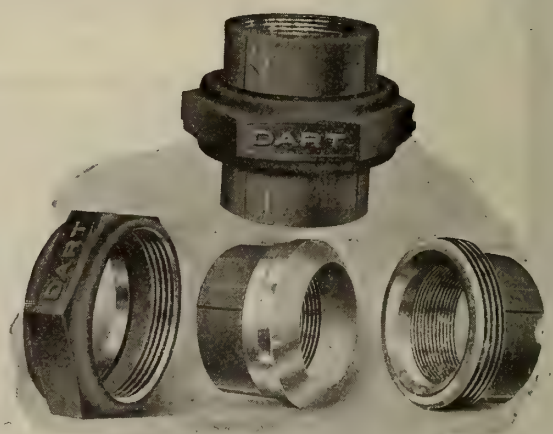

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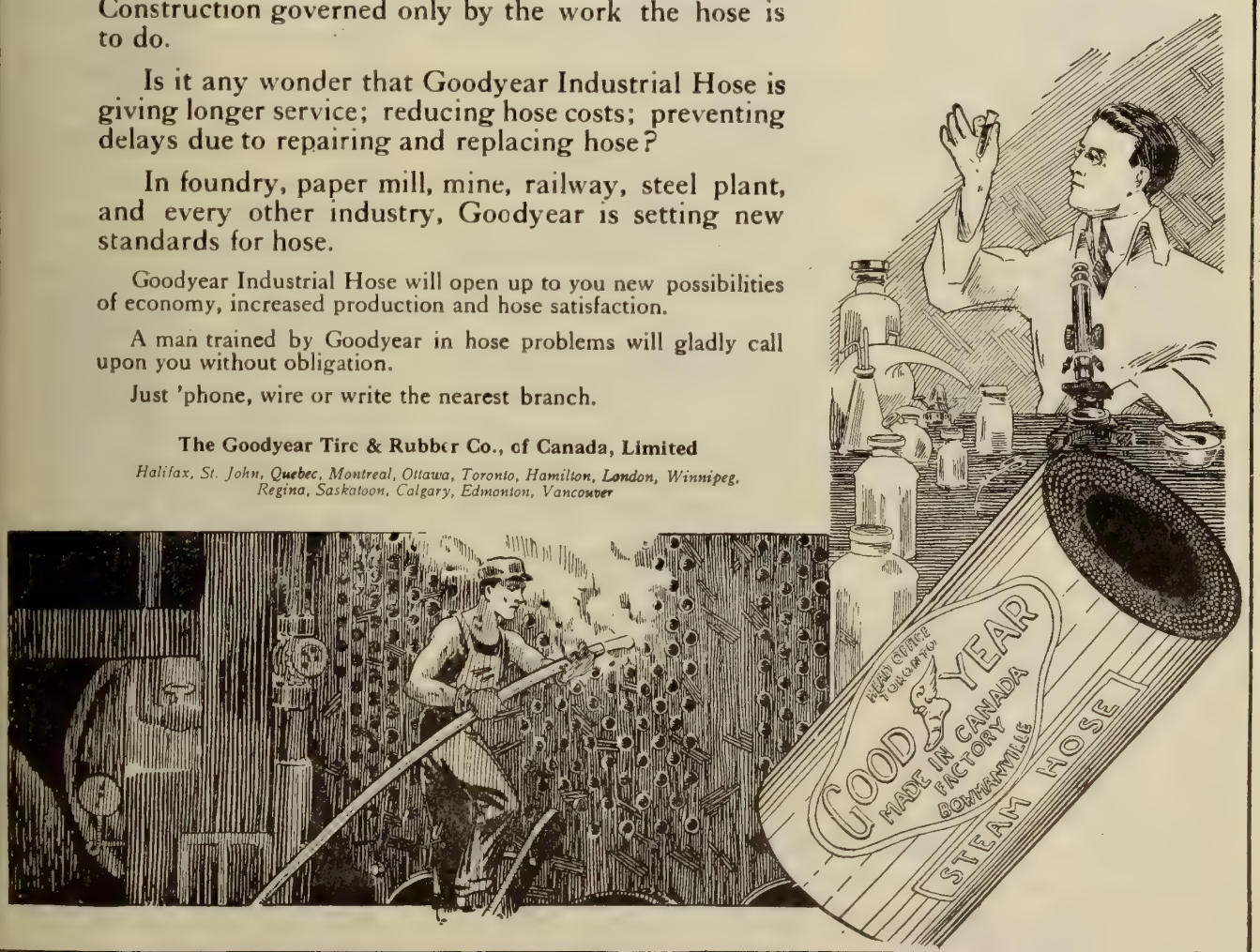

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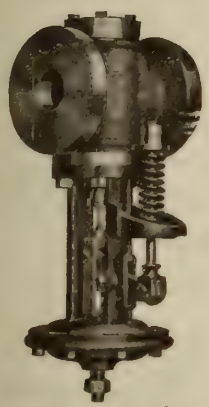

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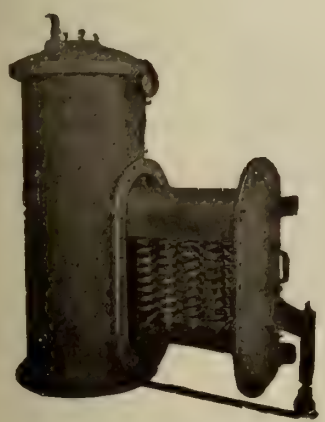

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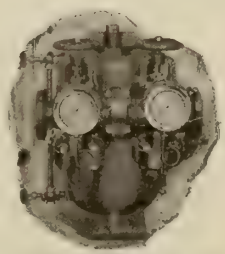

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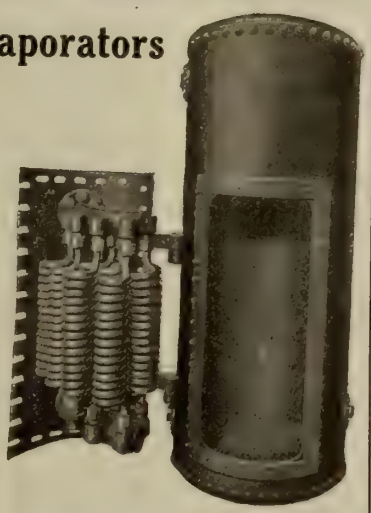

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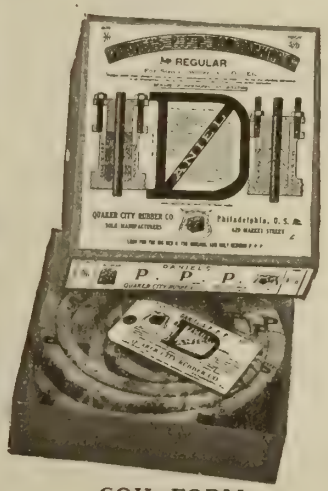

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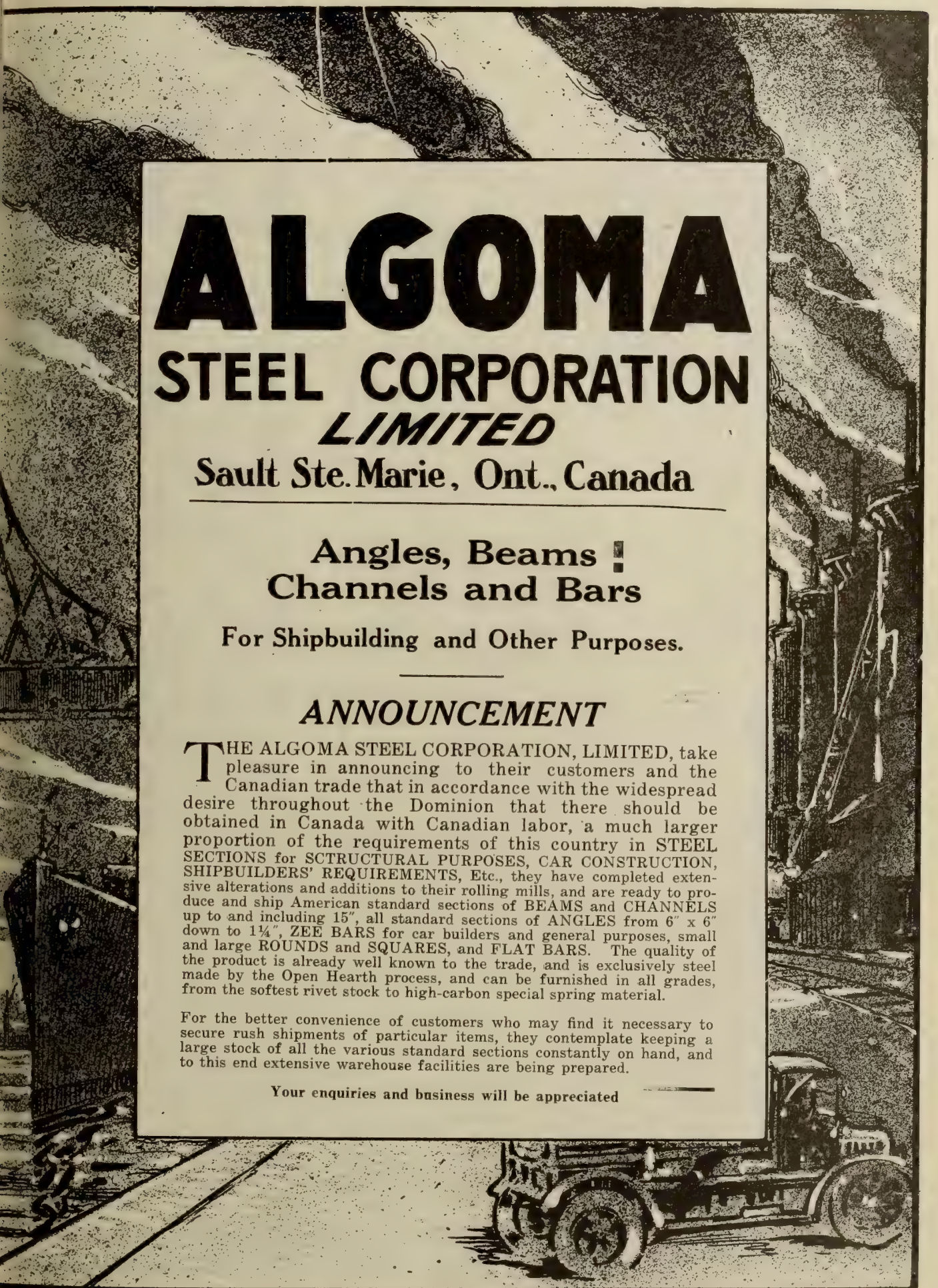

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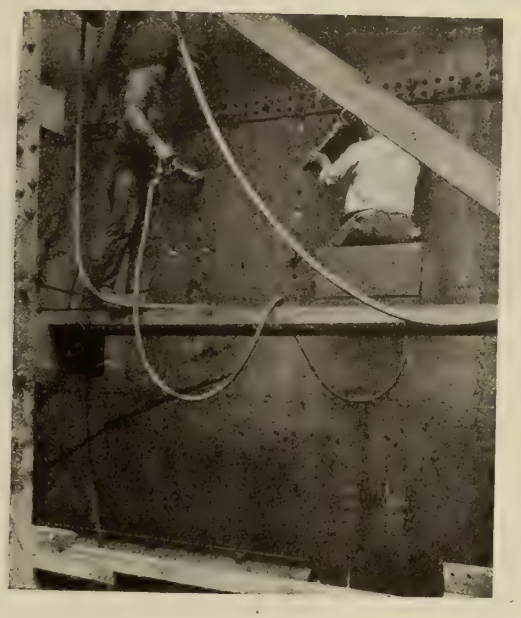

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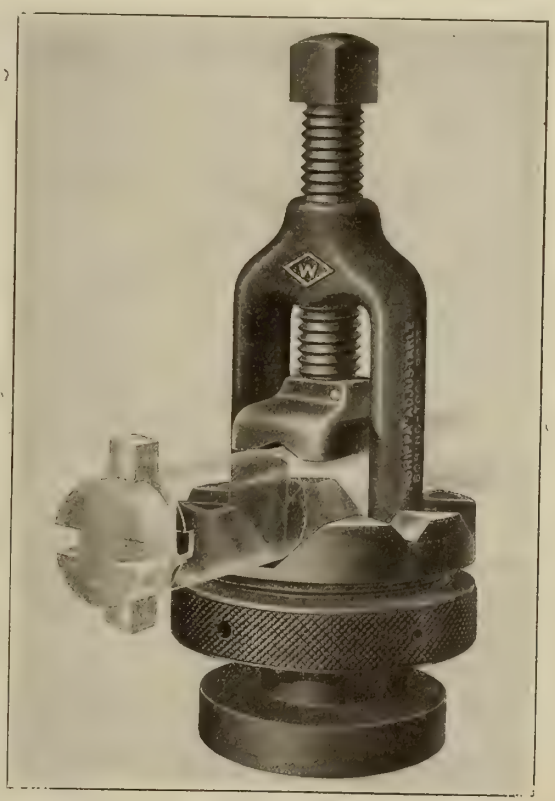

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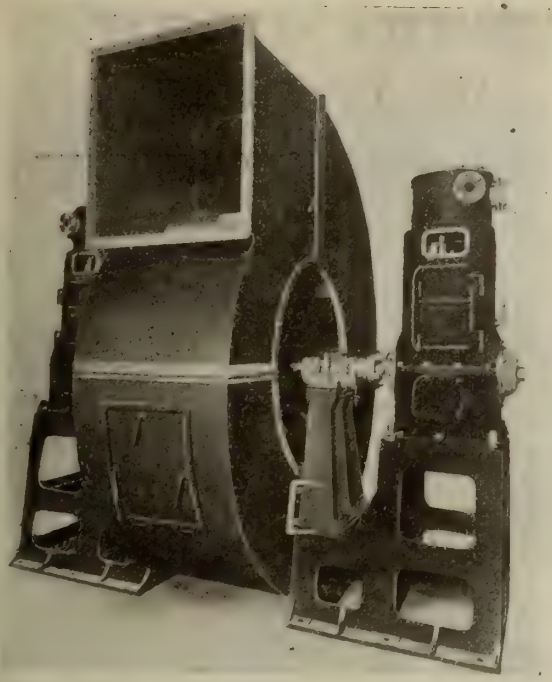

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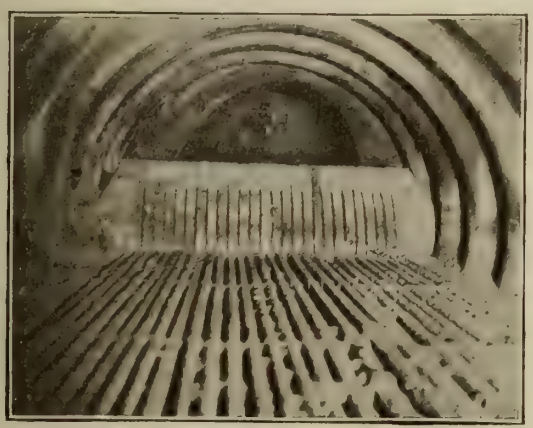

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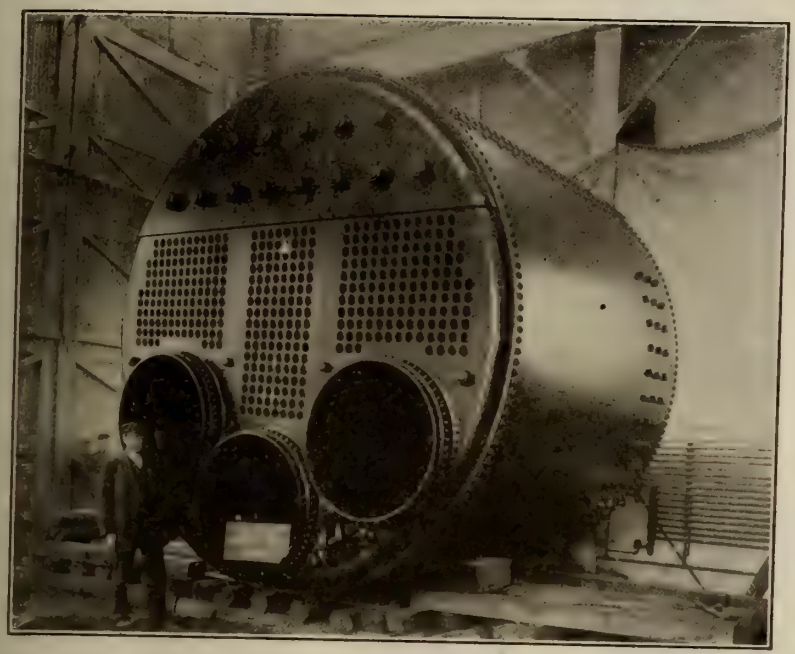

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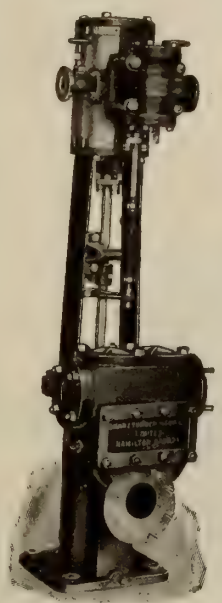

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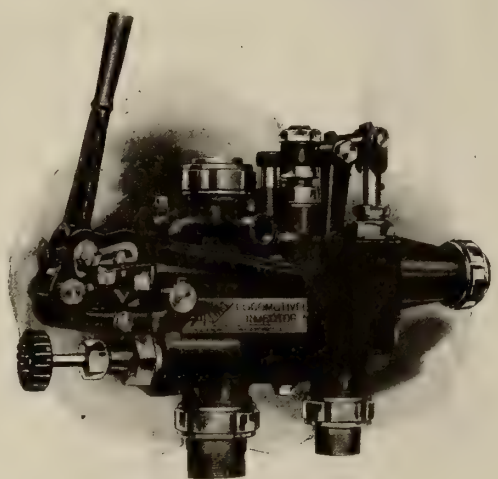

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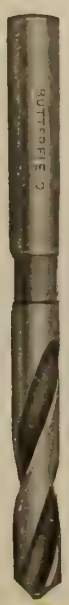

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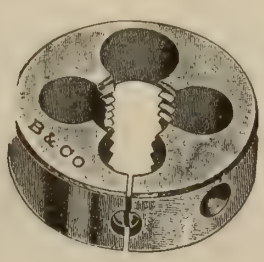

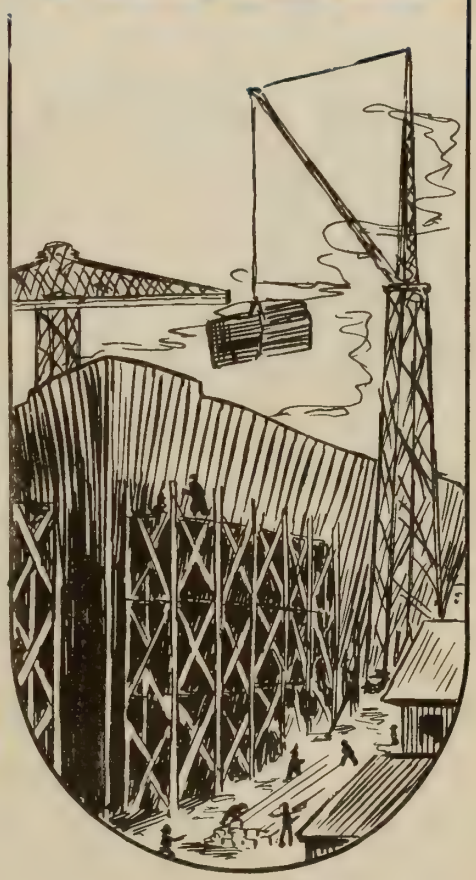

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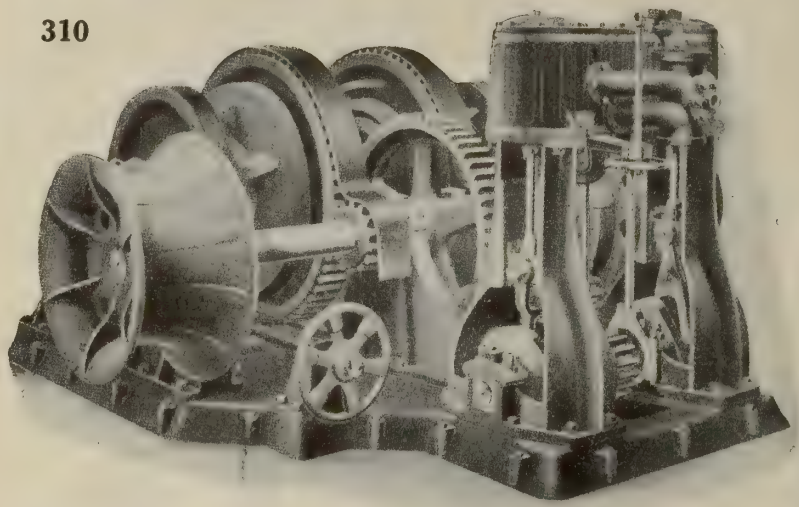

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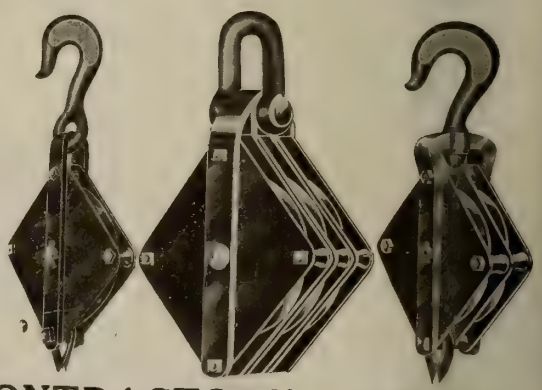

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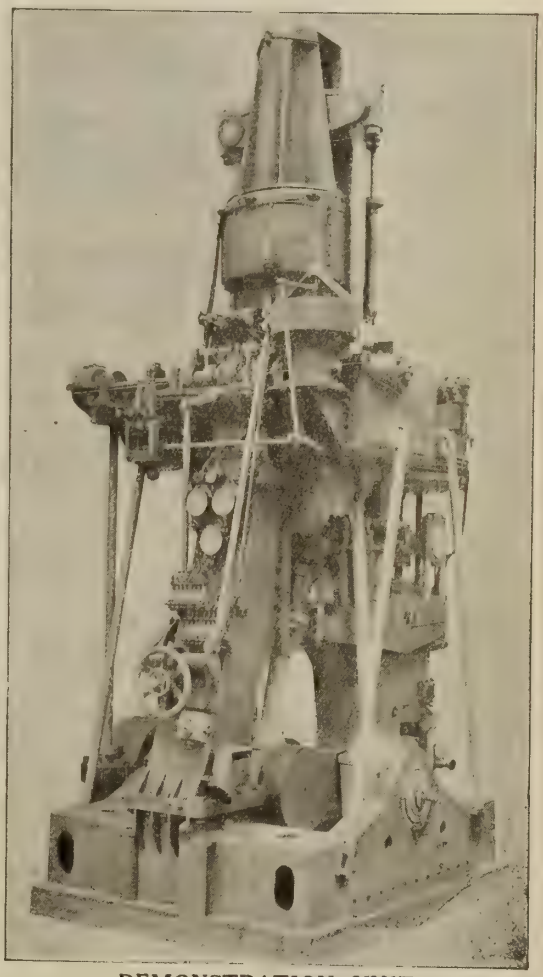

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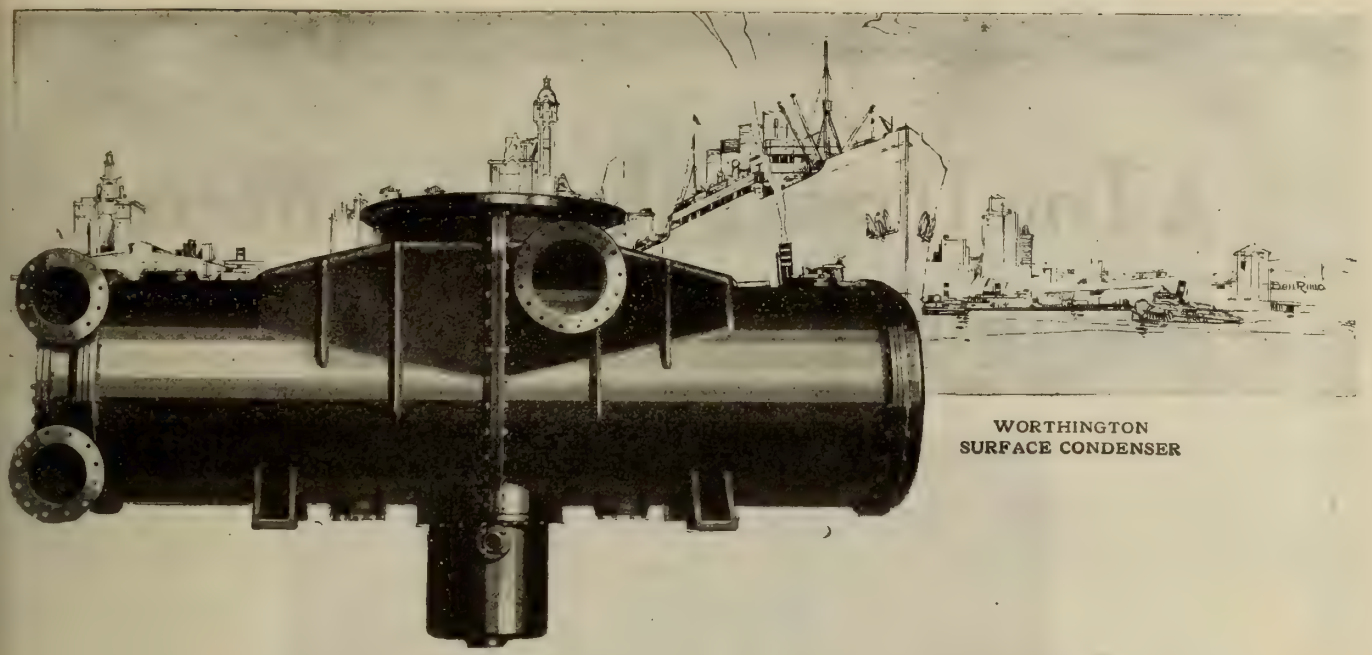

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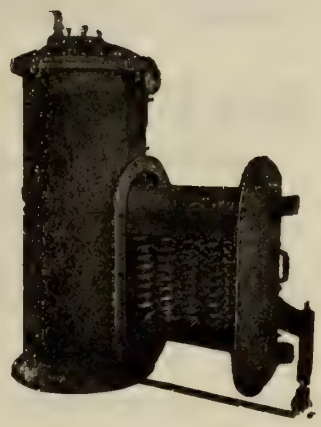

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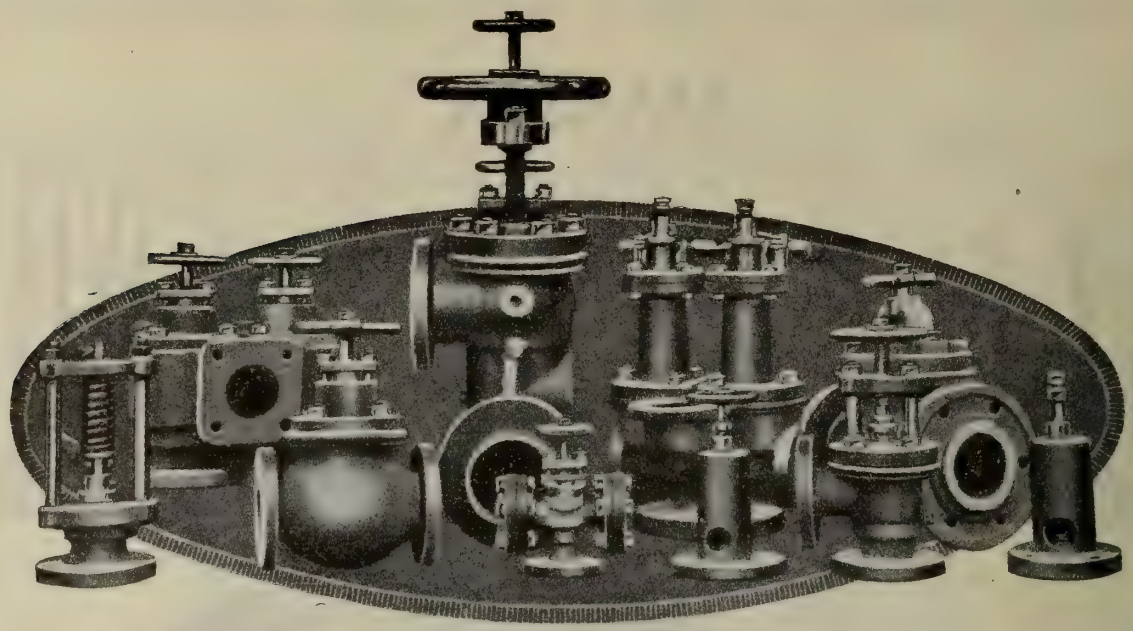

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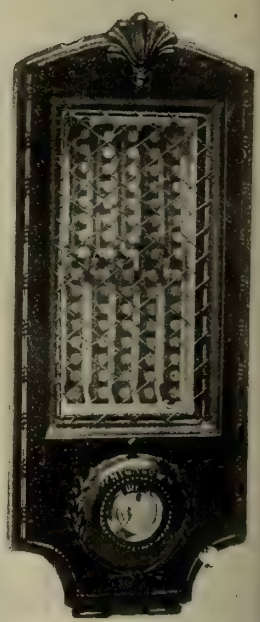

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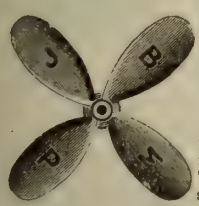

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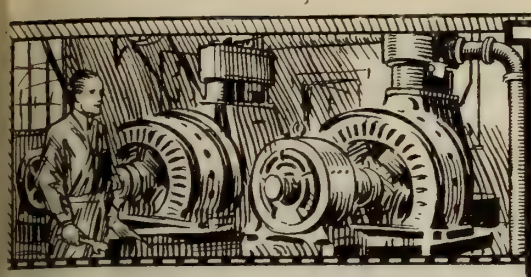

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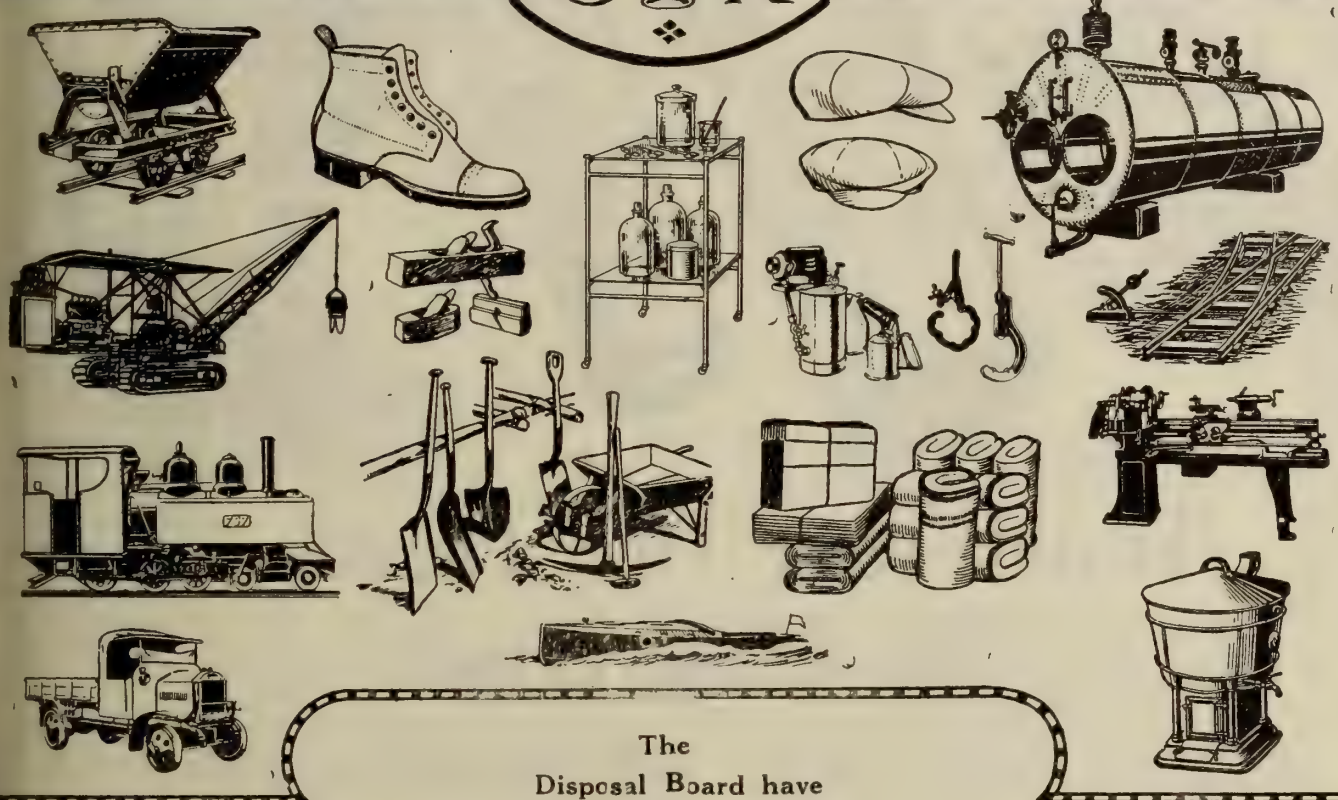

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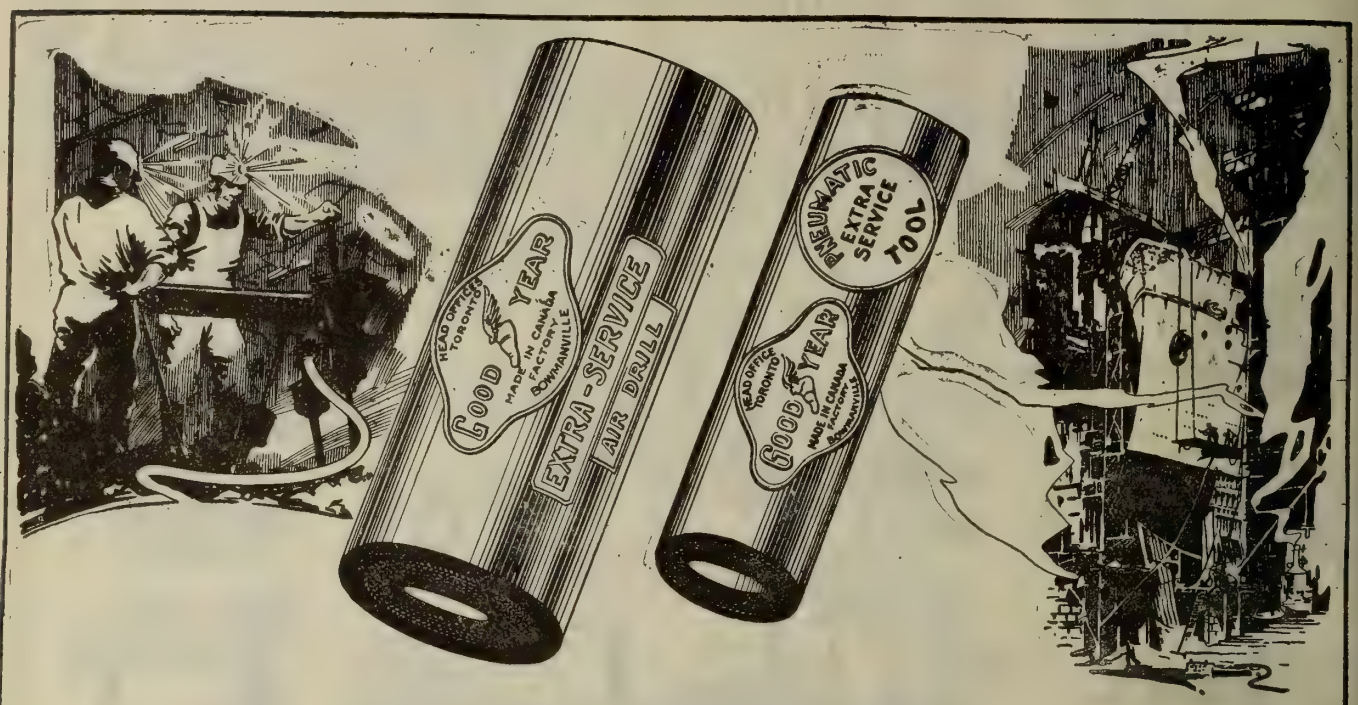

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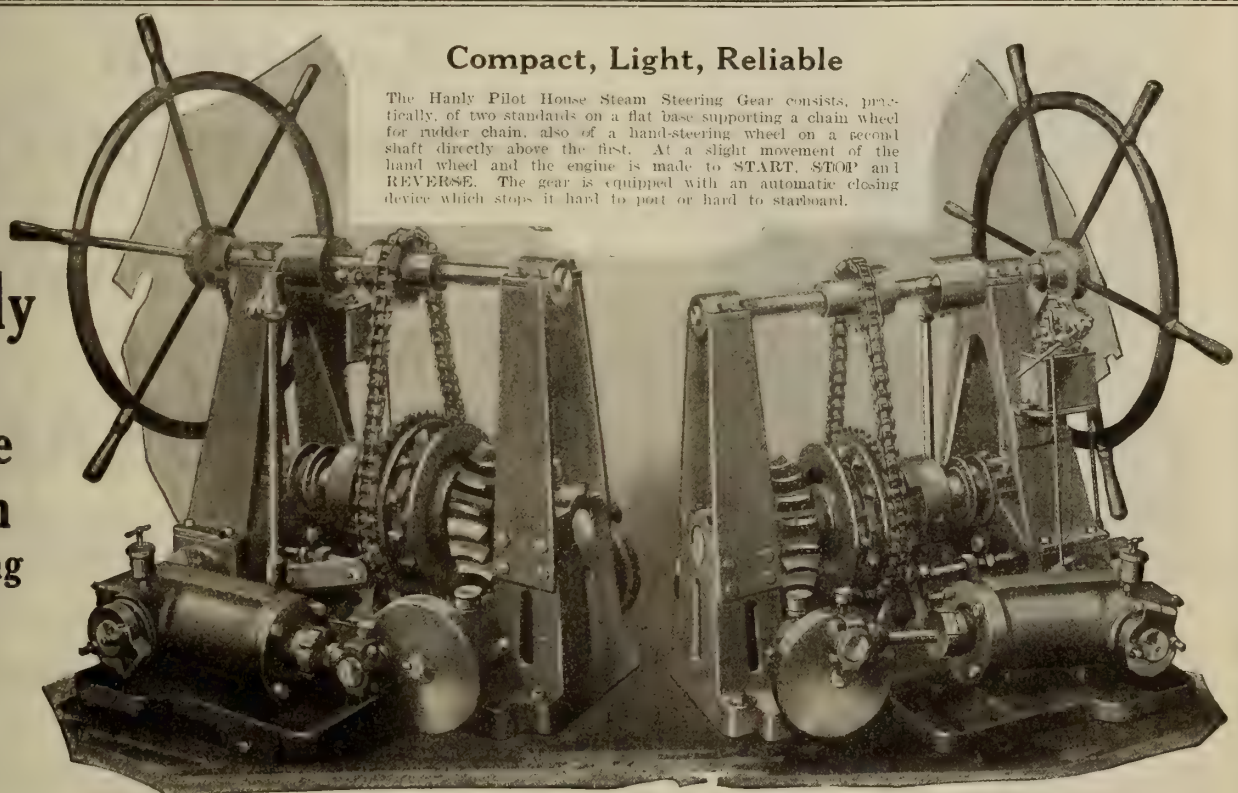

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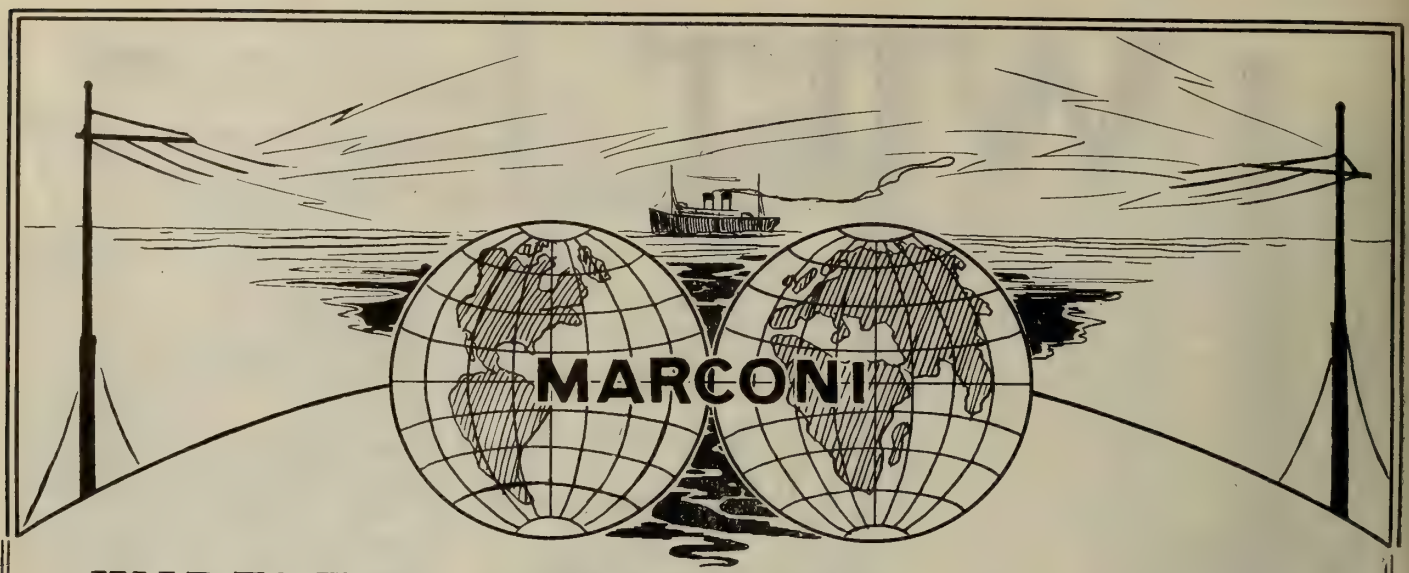

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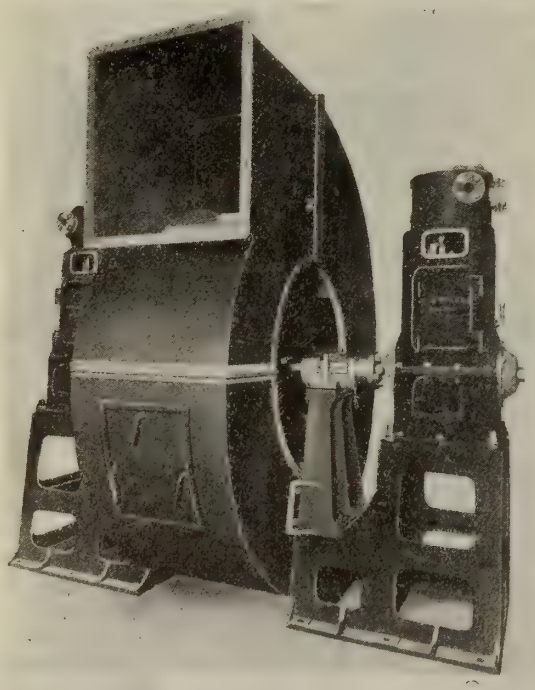

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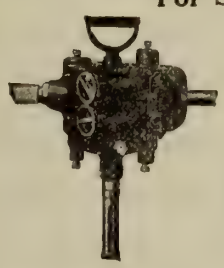

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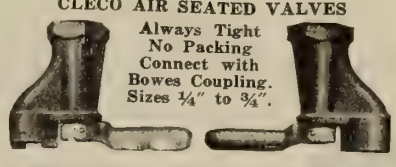

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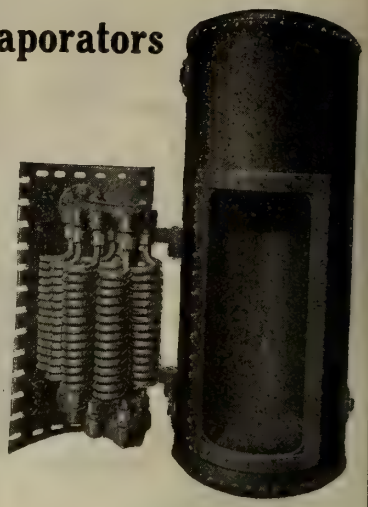

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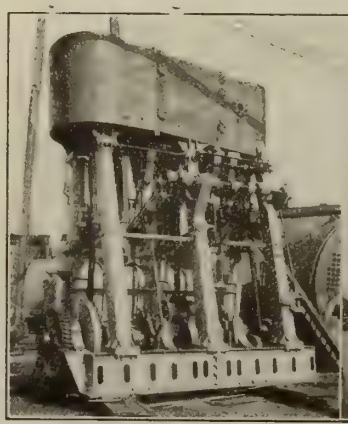

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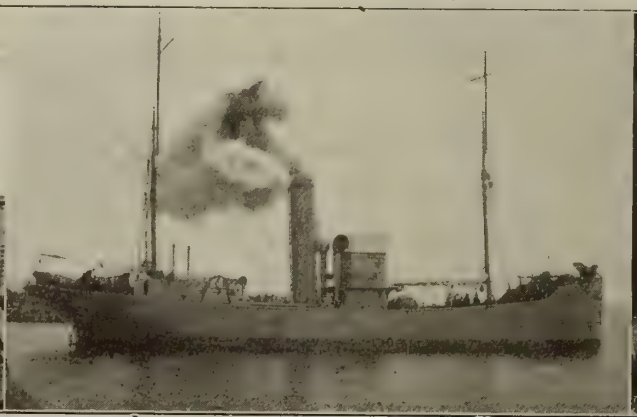

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Vol. X. APRIL, 1920 No. 4

The Propelling Machinery of H.M.S. Hood

A Brief Description of the Turbine Installation of This Greatest of All Battleships—Some Interesting Illustrations Are Incorporated Which Give a Good Idea of the Size of the Units

THE much talked of battle cruiser "Hood," the only one of the four of her type under construction to be completed, has had her trial runs. The power developed on these trials was 157,000 Shaft Horse Power, and the speed attained 32 knots. The leading dimensions of the "Hood" are as follows:—

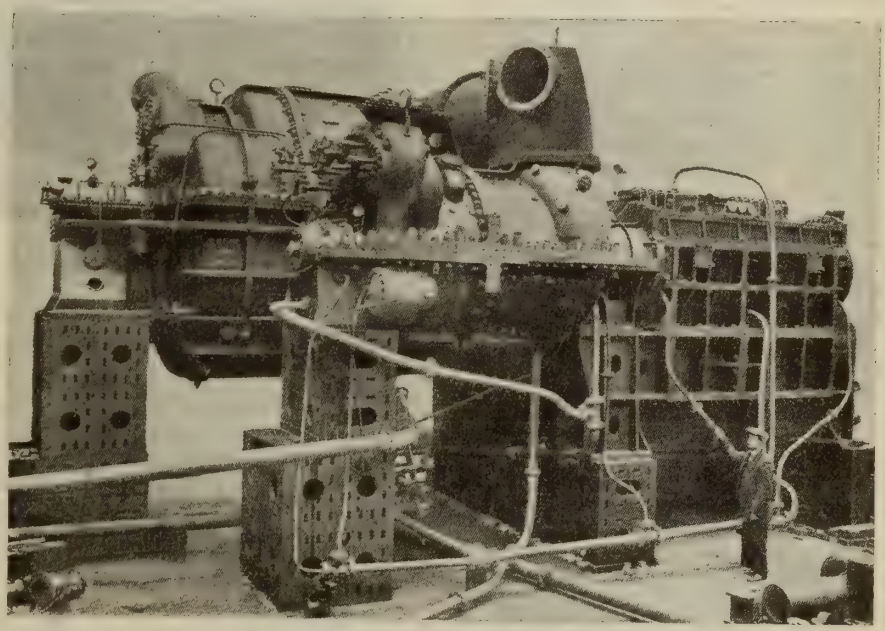
Length between perpendiculars 810 feet; length overall, 860 feet; extreme breadth 104 feet; mean draught loaded 28 feet 6 inches; displacement loaded 41,200 tons; shaft horse power (designed) 144,000; designed speed at load draught 31 knots. It is interesting to note the percentage of the total displacement that is required by the various component parts of the vessel. Thus equipment is 2 per cent. Armament 12.5 per cent.; machinery 13 per cent.; oil fuel 3 per cent.; armour and protection 33.5 per cent.; while the hull itself is 36 per cent. of the total displacement weight. It will be seen that the weight of machinery is comparatively low, when the speed and power of the ship are considered. This is largely due to the fact that small tube water tube boilers have been installed, instead of the usual large tube type hitherto used in the large battle cruisers of the navy.

The propelling machinery comprises four distinct sets, each driving one shaft, arranged in three engine-rooms, the starboard outer engine and the port outer engine being in the forward engine-room, the port inner engine in the middle engine room and the starboard inner engine in the aftermost engine room. The turbines are of the Brown-Curtis type, and each set of machinery consists of compound ahead turbines driving the propeller shafting through single reduction gearing. For use at cruising speeds a cruising turbine of the Brown-Curtis type is provided. This has a separate casting and can at will be connected to, or disconnected from, the main high-pressure turbine shaft, suitable clutches being provided to this end. At cruising speed this turbine is operated in series with the high-pressure and low-pressure turbines of the set. A reverse turbine is fitted within the low-pressure casing and rotates in vacuum when the ship is running ahead. Each of the four sets of machinery is complete in itself with its own condenser and auxiliaries, and can be used independently. The engine room telegraphs, worked from the conning-tower, are arranged so that the starboard telegraph in the conning-tower actuates the two telegraphs on the starboard side, in connection with the starboard outer engine and the starboard inner engine, and similarly on the port side of the ship, so that, as far as the navigation of the ship is concerned, the vessel is equivalent to a twin-screw steamer.

Each high-pressure ahead turbine rotor consists of 10 wheels, of which the first and second are velocity compounded having two rows of blades each, and the remainder are simple impulse wheels. Each low-pressure ahead turbine rotor consists of eight wheels, of the simple impulse type. Each cruising turbine rotor has four velocity compounded wheels with three rows of blades on the first wheel and two rows on each of the others. The stern turbine for each shaft is incorporated in the low-pressure ahead turbine casing, and consists of two velocity compounded wheels, each carrying three rows of blades.

The turbine casings are of cast-iron with the nozzle control valve seatings cast in the body. The rotor spindles are of forged steel, having a tensile strength of 34 tons to 38 tons per square inch. The wheels are of forged steel, of similar quality, and phosphor bronze has been used for the blades, which are of the usual impulse type. The blades have dovetailed roots, and the tips of the blades are supported by phosphor-bronze shrouding. The diaphragms are of cast-iron, with the nozzle blades of nickel steel (about 3½ per cent. nickel) cast in. The diaphragms in the cruising turbines and the first diaphragm in the high-pressure turbines are solid, the remainder of the diaphragms in the high pressure turbine, and those in the low pressure turbines, being split. The spindle is made steamtight where it passes through the diaphragms by segmental serrated brass rings, kept up to their work by garter copper-coated steel springs in the cruising and the first diaphragm of the high-pressure turbines, and by sherardized coach springs in the other diaphragms of the high-pressure and in the low-pressure turbines. The glands are packed, as is usual in Brown-Curtis turbines, with carbon rings made in segments and held in position by springs. The high pressure ahead forward end gland has eight carbon rings, the after end five, the low-pressure ahead four rings and the astern turbine four rings. The cruising turbine is fitted with five rings in each of the glands.

The condenser for each set is hung beneath the low-pressure turbine and has a total condensing surface of 24,400 sq. ft.



TURBINE AND CASING—LOOKING AFT.

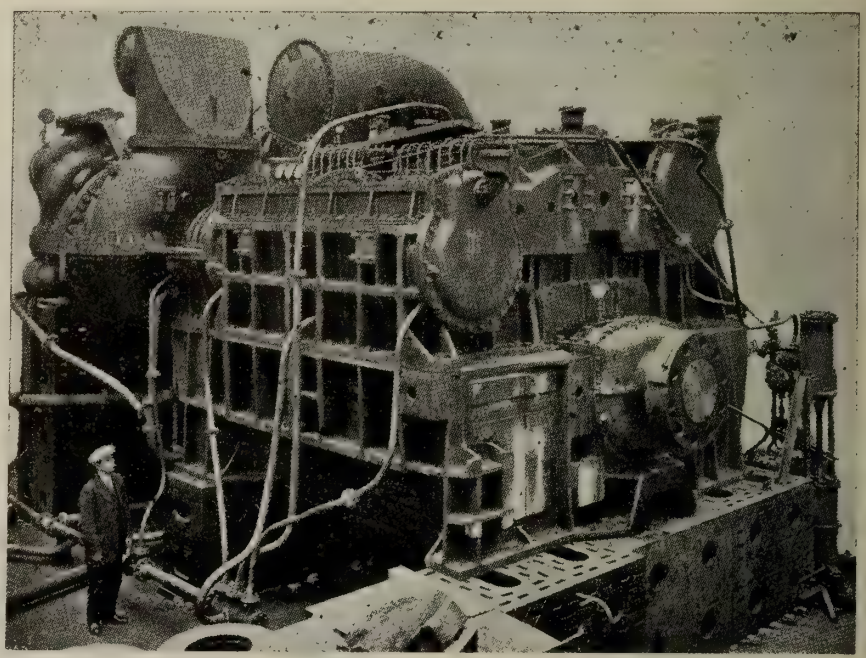
The tubes are ⅝ in. in external diameter, 0.048 in. thick and 12 ft. 3½ in. long between tube plates. The total number of tubes per condenser is 12,144. The condensers are of the Weir's Uniflex type with shells of steel plates and angles, the steam entering direct from the low-pressure turbine and flowing through the condenser, while the circulating water passes through the lower tubes first and then the upper tubes. The condensers are designed to give a vacuum of 28 in. with sea water of 55 deg. F. and a barometer at 30 in.

The engines are designed to develop a total horse-power of 144,000, with about 210 revolutions of the propeller and about 210 lbs. pressure in the control chest, with 28-in. vacuum in the condensers. The high-pressure turbine makes 1,500 r.p.m. at full power and the low-pressure turbine 1,100 r.p.m. As already stated, single reduction gearing is employed to reduce the revolutions of the turbine shaft to that of the propeller shafting. The pinion driven by the high-pressure turbine is 20.174 in. in diameter at the pitch centre, whilst that driven by the low-pressure turbine is 27.51 in. in diameter. The gear wheel has a pitch circle diameter of practically 144 in. These wheels are of the "built" type, Each wheel weighs about 46 tons. There are 392 teeth in the wheel, 55 on the high-pressure pinion and 75 on the low-pressure pinion. Hence, the ratio of reduction is 7.127 for the high-pressure pinion and 5.226 for the low-pressure pinion.

The thrust blocks on the rotor spindles, which also act as adjusting blocks for the rotors, are of the Michell type, as are also the thrust blocks on the propeller shafting. These latter measure 4 ft. 6 in. outside diameter of collar, with thickness of collar of 7½ in. This single collar takes the whole thrust on the shaft. The white metal surface of each thrust block amounts to 1,176 sq. in., both ahead and astern, giving a pressure on the thrust surface of about 200 lb. at full power ahead. The thrust shaft is 24 in. diameter, the intermediate shafting 24 in. diameter and the propeller shafting 28½ in. in diameter.

The propellers are of the solid type and are made of manganese bronze; they turn outwards when driving the ship ahead.

The main steam pipes are arranged in two runs along each side of the ship in the boiler rooms, one taking from each boiler room. They are of 19-in. bore. They are connected to the engine-room through two combined bulkhead and emergency valves on each side of the ship, and they are cross-connected in the forward engine-room. From the cross-connecting pipe are taken branches to the manoeuvring gears in each of the forward engines, and also a 19-in. branch to the middle engine-room and a 19-in. branch to the after engine-room. Between the steam pipe and the regulating valve on each engine is fitted a separator.



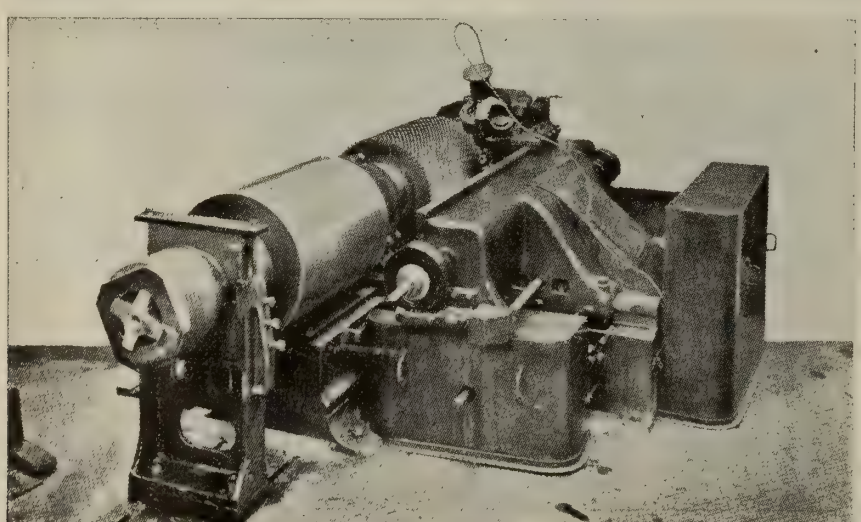
TURBINE AND CASING—LOOKING FORWARD.

Each set of main engines is provided with two main circulating pumps, the engines being of the enclosed forced lubrication type, and each pump having a 30-in. suction with a 31½ in. diameter impeller; two dual air pumps, the steam cylinder being 20 in. diameter by 20 in. stroke, the wet pump 36 in. diameter by 20 in., and the dry pump 33 in. diameter by 24 in. stroke; two grease extractors of the gravitation type, a direct contact feed-water heater, two forced lubrication pumps and one water service pump. There is, moreover, in each of the middle and after engine rooms an auxiliary condenser of 5,330 sq. ft. of condensing surface, with 5,390 tubes. In connection with these are two auxiliary circulating pumps of 18 in. suction and discharge and 27 in. diameter impeller, and two auxiliary air pumps. For the plummer blocks, a forced lubrication pump is fitted in the aft engine-room, together with a water service pump. There are also, in the engine rooms, six fire and bilge pumps, four oil-fuel tank pumps, a general service air compressor and four fresh water pumps.

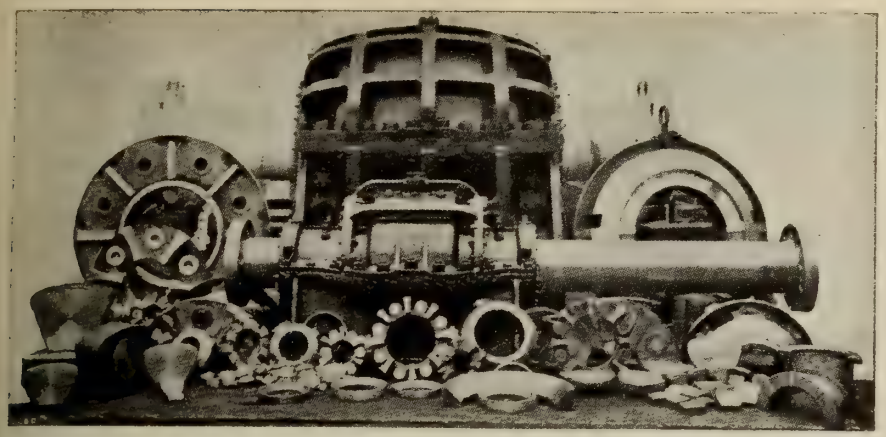
The distilling machinery is situated in the middle and after engine-room. In each engine-room is a set "A" and a set "B". Each set "A" consists of two 80-ton evaporators and one distiller, and can be used for supplying water for the ship's use or make-up feed water for the boilers. Set "B" consists of one 80-ton evaporator with a vapor pipe connected only to the auxiliary condenser in the engine-room in which it is situated, so that it is used entirely for boiler make-up feed.

The steering engines are situated in the after engine-room and are two in number. Each consists of three cylinders, with direct-acting engines 17 in. diameter by 14 in. stroke, worked by a hydraulic telemotor. In the middle engine-room a reciprocating electric generating set is installed, the engines having cylinders 14½ in. and 24 in. in diameter by 9 in. stroke, coupled to one 200-kw. generator. A similar set is situated in the after engine-room.

Steam is supplied by 24 Yarrow-type small-tube boilers, burning oil fuel, situated in four compartments, each having six boilers. The working pressure is 235 lb. per square inch, and the heating surface per boiler 7,290 sq. ft. There are two funnels, each serving two boiler rooms. Each of these measures 24 ft. 6 in. by 18 ft., with an outer casing at a distance of 6 in. from the funnel proper. Thie distance from the lower burners on the front of the boilers to



HOBBING A GEAR.



COMPARISON OF MITCHELL THRUST BLOCK OF H.M.S. "HOOD" WITH THRUST BLOCK OF A DESTROYER.

the funnel top is about 100 ft. There are 16 oil-fuel pressure pumps, four in each boiler room; these are all 12-ton pumps except two in the foremost boiler room, which are 24-ton pumps and are used for transferring oil fuel as well as for feeding the fires.

Each boiler room is fitted with six fans and engines. The fans have 90-in. impellers, and engines have cylinders 9 in. in diameter by 7 in. stroke. They are of the enclosed forced-lubrication type. The Weir's feed pumps have 15 in. and 10½ in. cylinders by 22 in. stroke, all of the same design. Six of these are fitted in each boiler room, four to act as main feed pumps and two as auxiliaries.

REPORT OF THE COMMITTEE ON CORROSION

The fifth report presented by Dr. Guy D. Bengough and his co-workers to the Corrosion Committee of the Institute of Metals is a study of the practical problems of corrosion, in condensers under service conditions, with either sea water or fresh water, and the greater part of it is devoted to a detailed consideration of the five main types of corrosion found in brass condenser tubes.

Of the four sections into which the report is divided the first deals with the "diagnosis" of condenser tube corrosion. It describes the procedure to be followed in withdrawing a tube and preparing it for examination, and also the symptoms or appearances within the tube which correspond to each of the five main types of corrosion. The importance of detailed information about the water supply and the tubes themselves is emphasized. In the second section certain features in the structure of the tubes are referred to, in particular the presence on them of a surface layer consisting of structureless and highly distorted metal. This layer has a greater resistance to corrosion by saline and fresh waters than the underlying crystalline metal, so that whenever it is penetrated corrosion proceeds at an increased rate. Its thickness is usually of the order of 0.01mm., and indications have been obtained that its composition may be rather different from that of the underlying metal.

General Thinning

Of the five main types of condenser type corrosion the first "general thinning," may be considered an accelerated form of the complete corrosion which normally occurs in saline solutions, in so far as the tube is gradually and uniformly reduced in thickness The rate of ordinary complete corrosion is too slow to be of serious practical consequence. In practice tubes almost always fail by local action of some kind long before ordinary complete corrosion has seriously reduced the thickness. Rapid general thinning is, however, essentially a fresh-water phenomenon, and is usually associated with the presence of free acid in the water supply.

Deposit Attack

The pitting which is the most frequent source of trouble in condensers is principally due to "deposit attack." In the presence of sodium chloride solutions the cuprous oxide formed on a brass surface gradually changes to cuprous chloride. The latter is usually swept out of a condenser tube by the circulating water, but under various conditions may adhere at different parts of the tube surface. When such adherence has occurred, conditions allow of the further gradual change of the insoluble cuprous chloride under the influence of oxygen to soluble cupric chloride and cuprous oxide. The action of cupric chloride solution on brass is very rapid, as may be gathered from the fact that a piece of brass tube 2 in. long, placed in a strong cupric chloride solution at ordinary temperature, was completely disintegrated and partially replaced by a pseudomorph in copper in two days. The action involves the oxidation of the copper and reduction of cupric chloride to cuprous chloride: redeposition, of copper from solution by the zinc also occurs. In the presence of air cuprous chloride will again be converted to cupric chloride and the attack on the brass continued. Thus the action is both recurrent and local. Foreign bodies, and particularly colloidal bodies, lying in the foci for the adhesion of cuprous chloride and tube have an injurious effect by serving as by preventing the diffusion of cupric chloride. Observations on the incidence and distribution of pits in condenser tubes agree with the results which would be expected to follow from the above explanation of the mechanism of pitting. Attention is drawn to the importance of keeping tubes clean and as free as possible from foreign bodies as a means of preventing deposit attack.

Layer Dezincification

As to the mechanism of so-called dezincification, the conclusion is reached that true parting of zinc and copper in a 70:30 brass does not occur, but that the so-called residual copper is always redeposited copper. Dezincification is therefore only apparent and not real. The layer type of dezincification, which is characterized by disintegration of the brass tube and redeposition of copper over large areas, has been found to occur under both marine and fresh-water conditions. Such action may occur in the presence of acids, particularly hydrochloric, when not too dilute, especially when the temperature is high; under the action of electric currents passing from the tube to the circulating water when the latter contains certain chlorides; and in the presence of certain neutral or nearly neutral chloride waters, when the conditions are favorable to the formation of cupric chloride, such as an elevation of temperature. Under fresh-water conditions it is often associated with acid water, particularly if the acid is not too dilute and the access of oxygen is not very easy.

Plug or Local Dezincification

The type of local corrosion distinguished as plug dezincification may be regarded as a form of deposit attack, as it always proceeds beneath a deposit, and is stimulated by the presence of foreign bodies. It differs, however, in many ways from "deposit attack." So far as is known it occurs only in sea-water (or diluted sea-water), and is always associated with adhering white salt consisting of colloidal zinc oxychloride (also containing some carbonate). It manifests itself by the spontaneous formation on the corroding brass surface (while completely immersed in the corroding liquid) of specks of tightly adhering white substance, which when detached always disclose in the early stages bright untarnished brass and later reddish areas of spongy copper. The production of the right concentration of zinc in the liquid layer adjacent to the corroding brass surface plays a large part in the formation of the characteristic white oxysalt, and interference with the production of this condition, *e.g.*, by lowering the zinc content of the brass or by raising the zinc content of the sea-water, is sufficient to prevent its occurrence.

Water-Line Attack

In the case of a brass tube only partially immersed in sea-water, increased corrosion (compared to that of the immersed portion) takes places, not at the water-line, as is commonly supposed, but above it, and sometimes as much as 2 cm. above the air-sea-water surface. Further, the attack is not uniform, but is concentrated at areas where salt deposits have formed and is coterminous with the area covered by the deposits. Narrow bands of salt connected the sea-water with the deposits. This type of corrosion is obviously a special form of deposit attack, taking place under the most

(Continued on page 89)

A Description of a New Type of Shipyard Crane

In a Paper Read Before the Institute of Engineers and Shipbuilders in Scotland, the Author, W. Hok, Member, Gives Some Interesting Particulars of a Crane Used in a Swedish Yard

INTRODUCTION

SOME eight years ago it was decided by the Lindholmen Shipbuilding and Engineering Company of Gothenburg to demolish two of their three existing shipbuilding berths suitable only for the construction of small ships, and on an enlarged site to lay down three new berths for the construction of ships up to 12,000 tons deadweight. For this purpose about 500,000 cubic feet of solid rock had to be removed.

In the spring of 1913 it became imperative to decide what kind of hoisting appliances should be adopted for the new berths, and in June of the same year I set out to visit about 40 shipyards in Denmark, Germany, Holland, Belgium, England, Scotland, and Ireland in the order named. These 40 yards I saw from inside the gate, but many others in the neighboring localities I viewed from the outside only, either from land or river, a procedure sufficient when my object was the study of shipbuilding berth cranes only.

Previous to going abroad I was aware of the very expensive arrangements used, for instance, by Messrs. Blohm and Voss and the Hamburg Vuclan Company at Hamburg; by the Stettin Vulcan Company at Stettin; by Messrs. Swan and Hunter on the Tyne; by Messrs. Harland and Wolff at Belfast, etc.; and, further, I knew of most of the published super-expensive arrangements used in the United States. I was not, however, in search of an expensive arrangement, but of an efficient and at the same time comparatively inexpensive one, such as a shipbuilding company with a modest purse could afford to adopt.

During my travels I found that a large number of very efficient and fully competitive yards, both in Great Britain and abroad, adhered to the ordinary mast and derrick arrangement, some using wooden masts with wooden derricks, others lattice masts with lattice derricks, or mixed. Invariably the hoisting winch, whether steam or electric, common to two or more derricks, was placed on the ground level, with the attendant trouble of having the hoisting rope leading from the winch to the derrick mast always entangled in bars and plates, staging uprights, and all sorts of rubbish. Besides, signal men placed here and there were part of this equipment, as the winch operator could not as a rule see what he was doing. Other yards were equipped with all kinds of expensive overhead travelling-cranes—gantry cranes, for instance, consisting of a very high and expensive steel structure on each side of the building berth, on which travelled a heavy overhead crane extending right across the berth. Others again were equipped with cantilever cranes common to two contiguous berths, and running either on rails laid on the ground or on a high gantry erected between berths. Some yards were provided with revolving cranes, movable the whole length of ship. And of these revolving cranes the same story can be told as before. Either a high tower-crane travelling on rails laid on the ground or a smaller revolving crane running on rails laid on a gantry erected between berths. In one yard I saw ordinary steam revolving-cranes running on rails laid on a gantry of moderate height erected at each side of the building berth. In this instance the gantry was so built that it could be moved sideways for the whole of its length, if necessity should arise for building broader ships on this particular berth than was originally intended; while in other yards stationary revolving tower-cranes were used.

But what struck me most of all was that, on the whole, nobody seemed entirely satisfied with the crane arrangements he possessed. This conclusion I came to, partly by the views expressed to me by the parties concerned, and partly by the fact that in shipyards having a number of building berths the same system of berth cranes was never carried consistently through On the contrary, it was almost always the case that a different system of cranes was tried at almost every building berth in the same yard and for every new berth laid down. Further, I noticed that on the whole the tendency was to discard very expensive crane sheds, covered in or not, and to substitute cheaper arrangements.

In a very famous yard in the North of Ireland stationary revolving tower-cranes were thus being erected in lieu of covered-in sheds, and in another yard in the same district high revolving tower-cranes movable on rails laid on the ground had just been erected between the berths, but these cranes were not allowed to be moved more than once a day. In another yard, which I know well, the travelling tower-crane is not allowed to be moved at all until the section of the ship covered by the crane is completely erected. In a well-known yard in the North of England, which I visited in the summer of 1919, a yard also known for expensive sheds carrying overhead travelling-cranes, I found that a new building berth had been recently laid down, and in this particular case a very modest hoisting arrangement adopted consisting of lattice masts with two lattice derricks on each mast, all in connection with electric winches placed on the ground level.

From what I had seen I could not help drawing the conclusion that those builders who had in the past gone in for very expensive berth cranes were not wholly satisfied with their investments, having undoubtedly found that the efficiency of their hoisting gear was not commensurate with its cost, and, further, that after all they could not with their expensive crane arrangement do much better than their neighbors working with simple and comparatively inexpensive appliances. I thus decided in favor of a simple and comparatively inexpensive crane arrangement.

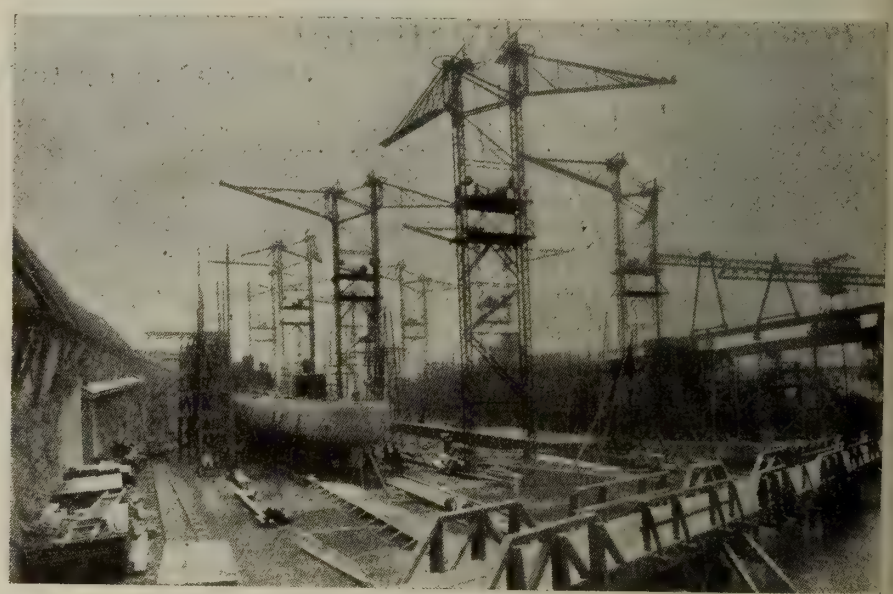


FIG. 2.

After considerable thought, and having turned things over in my own mind, I came to the following broad conclusions:—

(1) The mast and derrick arrangement is quite satisfactory, provided it can be so arranged that all side staying of masts can be done away with.

(2) The operator's platform should be placed high up above the ground on, for instance, the level of the principal weather deck of the ship, so that the operator can see what he is doing, thus obviating the necessity of using signal men.

(3) The lead from the hoisting winch to the derrick mast should not be taken along the ground among staging uprights, shoring, plates and bars, and various rubbish strewn about the ship. The lead from the winch should be free from all obstructions.

(4) A space or passage-way is desirable between contiguous ships to enable building

material to be brought down between ships and hoisted on board from the nearest point at the ship's side, and not from the ship's end only. Such an arrangement covers many more chances of rapid building than an arrangement based, for instance, on the material being taken in hand by the hoisting gear at the end of the ship only, because the former arrangement offers so many more points of attack on the ship than the latter.

Description

Guided by the leading features just mentioned, I designed the stationary building-berth crane which is described and illustrated in Figs. 1 to 4, eight of which are erected at the Lindholmen Works, and have been in good use since 1914. In this connection it will be noticed, by referring to Figs. 1 and 2, that the only one remaining of the old building berths at Lindholmen, on the right in Fig. 2, is fitted with a high gantry and a couple of overhead travelling cranes, an arrangement some 15 years old which I could not afford to demolish.

It will be seen by the plans, Figs. 3 and 4, that the new type of berth crane is chiefly composed of a stationary main structure and two swinging arms, the former consisting of two lattice-work masts placed about 15 feet 3 inches apart from centre to centre, and rigidly connected to one another by cross stays and trusses, making the main structure stable in the thwartship direction, thus obviating the necessity of fitting the objectionable side-stays which are an inevitable essential of the ordinary mast and derrick arrangement. A structure, such as the one depicted, consisting of two derrick masts rigidly connected to one another by cross stays and trusses, I have subsequently taken the liberty of calling a derrick frame in contradistinction to the solitary derrick mast.

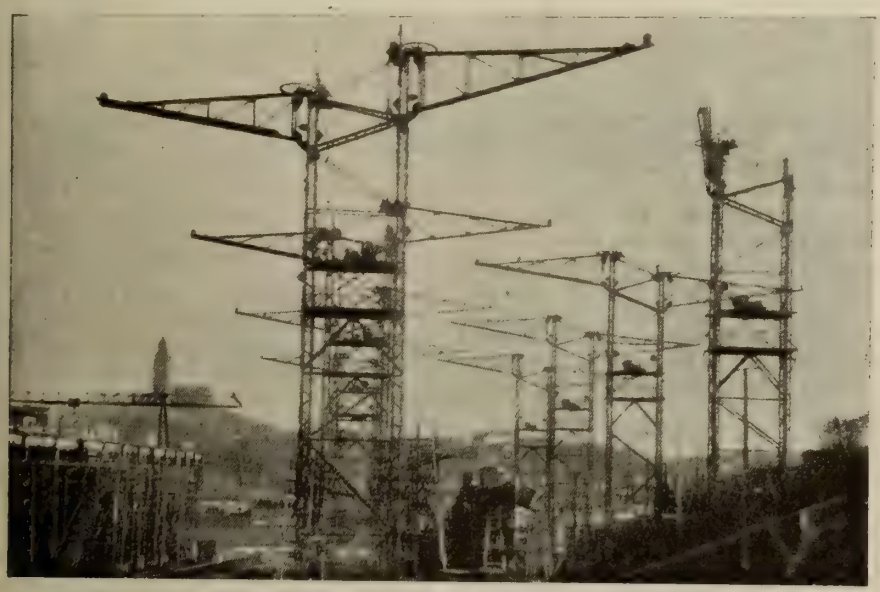


FIG. 2.

Each derrick frame carries two derricks or arms A, as shown, which can swing about 120 degrees to each side of a vertical thwartship plane through the derrick frame, *i.e.*, well past the centre line of railway B, Figs. 3 and 6, laid down in the passageway between contiguous ships. The derrick frame is held in place by fore and aft wire stays only, as shown in Figs. 1 to 5, *i.e.*, by two sets of stays, the lower ones C, in Figs. 4 and 5, being fitted, partly for giving rigidity to the frames in a fore and aft direction, partly for preventing collapse of a whole group of interconnected cranes in case for some reason the top end stays R, Fig. 5, or some of the top stays D, Figs. 4 and 5, fitted from crane top to crane top of that group should give way.

At a suitable place above the ground two operators' or winch platforms E, Figs. 3, 4, and 5, are built into the derrick frame, the one above the other, access to which is obtained by ladders inside the frame legs F, Figs. 3 and 4.

Each crane arm and the load are in the present case controlled from their appropriate aerial platform E by a single ordinary alternating-current electric shipyard winch G, Figs. 3 and 4, that is to say, controlled by one electric motor only. *Hoisting* and *lowering* are done with the winch centre barrel in the ordinary way, and *slewing* with the extended winch ends by taking a couple of turns round the appropriate extended winch end with the loose end of a tackle H, Figs. 3 and 4, actuating the wire J which, as shown in Figs. 3 and 4, is carried round and fastened to the rim of the horizontal wheel K on top of the crane. The wheel is fixed to the top centre pin of the crane arm.

It is perhaps necessary to mention that a spiral spring N is introduced above the slewing tackle, Figs. 3 and 4, for the purpose of taking up the inertia of the crane arm when it arrives at the extreme end of the swing, in this way preventing damage and unnecessary straining of the connections in case of rough usage or ignorance on the part of the man handling the crane. For the crane is so easy to manipulate that any ordinary platers' helpers or laborer can officiate.

Racking is done with a small hand winch L, Fig. 3, only. It is here to be remarked that, for my own part, I do not attach much importance to the racking motion, and hold that if the cranes are high enough there is no necessity for adjusting to such a nicety the position of the trolley M, Fig. 3, on the crane arm as to cause the material hanging in the hook to absolutely plumb the poin where it is going to be placed. The material can on most occasions be pulled into position without an effort as long as the trolley on the crane arm is approximately where it should be. It will be noticed that the lower member of the arm along which the trolley moves is not horizontal, but slightly sloping. It is in this case purposely so arranged in order to make it comparatively easy to move the trolley towards the outer point of the arm, when there is no weight on the crane hook, and to make it very easy to move the trolley towards the derrick frame when the load is on; and for these reasons the trolley M is always moved, before the weight is on, as far out towards the extreme end of the arm as considered necessary in each individual case, and it is then afterwards a very simple matter to adjust the trolley in the direction of the derrick frame, if necessary, after the load is on. In practice this method has shown itself satisfactory and quite sufficient.

But apart from this reasoning and experience, it should be understood that if anybody should prefer to manipulate the crane with three motors, one for hoisting, one for slewing, and one for racking (the member on which the trolley travels being in that case horizontal), it can, of course, be easily done. The method I have adopted is, however, in my opinion satisfactory and quite sufficient, and it certainly has the merit of being simple and inexpensive.

The frame legs stand on joists P, Figs. 3 and 4, laid thwartship, and about 3 feet apart—*i.e.*, the fore and aft dimension of the frame legs apart. These two joists are securely fixed to the solid rock, and the frame legs are securely bolted to the upper flanges of the joists. In this way is the transverse stability of the crane doubly secured.

The present cranes were built flat on the ground. Since the arms had been fitted on to the frames and secured, the cranes were raised into a vertical position, and then screw-jacked into their absolute position.

Dimensions and Capabilities

The frames of the present cranes have a height above the ground of 110 feet, the section of each frame leg is 22 inches wide by 36 inches in a fore and aft direction. The crane arms are about 40 feet long, the upper winch platform is about 60 feet above ground, the lower platform is about 8 feet below the upper one, and the height from the ground to the underside of crane hook in its highest position is about 90 feet. Ball bearings are fitted throughout. The clear distance between the frame legs is 13 feet 6 inches, thus admitting one or perhaps even two parallel railways between the frame legs and between contiguous ships. It will thus be seen that with these cranes 22 feet only are required between contiguous hulls, counting 28 inches from the crane leg to the hull side, which distance is quite sufficient when pneumatic riveting hammers are used. If 22 feet are not available between adjoining hulls, this distance can be made somewhat less by reducing the distance between the frame legs. The structure is stable sideways all the same as long as the frame legs are securely fastened to the ground.

It is to be explained that at Lindholmeu

uprights for carrying the stage planking surrounding the vessel are not nowadays used, except at the extreme ends of the vessel. For such support angle brackets are now bolted to the shell plating—an arrangement which is much tidier and less obstructive, and which takes up much less room in a thwartship direction than the old method with uprights.

The present cranes were built to lift 2½ tons at the extreme end of the arm. But it was soon found that they could be put to better use if some of them could be made to lift a heavier weight. The whole crane calculation was then gone into again, and it was found that with a slight strengthening of the lower members of the arms and of a few connections the cranes could, without undue straining, be made to lift 5 tons at the extreme end of the arm and 10 tons at about 10 feet from the derrick frame. Since this strengthening took place there has been, for ships up to 7,000 tons deadweight, lifted on board and lowered into position while the ships were still on their building berths, every particle belonging to them, including the main engines, with the exception, however, of the boilers, uptake and funnel, and this summer it is intended to launch ships 8,000 tons deadweight, having their engines completely erected in place on board. It must, however, be explained in this connection that engine-room weights exceeding 5 tons are first lifted on to the ship's deck by a single crane, and then two or three of the cranes surrounding the engine-room are combined for the purpose of lowering the weights down the engine-room hatch.

I have, further, to draw attention to the fact that one group or both groups of cranes surrounding a ship can be shifted sideways without great difficulty, the joists on which the cranes stand being made specially long for this purpose, which device is useful to have in hand in case it should be considered advantageous to build a broader ship on the building berth than can go between the cranes in their present position. For instance, for berth No. 3 the cranes are now set for ships up to 65 feet in breadth, but they can be shifted sideways on the joists so as to admit ships 80 feet broad by sacrificing adjoining berths to a corresponding extent. But it is evident that it would only be in case of a very tempting contract or of urgent necessity that one would thus shift the cranes, for the fore and aft wire stay ground attachments and the railway situated between the berths would necessarily also have to be moved. But, in any case, with this system of cranes shifting the cranes sideways can be done, if necessary, and almost as easily as with the ordinary solitary mast and derrick arrangement.

The cranes can, naturally, be placed as close together as one may like in the direction of the length of the ship—for instance as close together as ordinary masts and derricks are generally placed, and the crane arms can, of course, within reasonable limits, be made as long or as short as one might fancy, either overlapping each other or not. All this is a matter of taste or requirement.

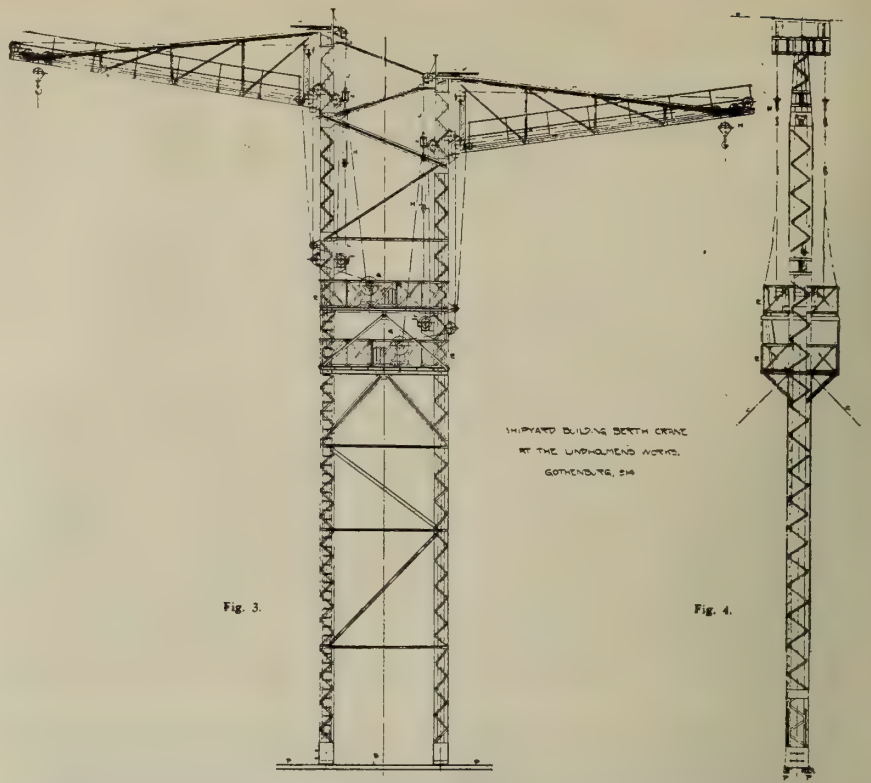


Fig. 3. Fig. 4.

FIGS. 3 AND 4.

It is perhaps, then, not inappropriate finally to point out that the present crane design is very elastic—that is to say, the dimensions and capabilities of the crane can be varied within considerable limits, such as in regard to lifting power, length of arm, distance between crane legs, etc., without loss of any features inherent in the design of the crane.

Regarding the saving of labor costs and increased rapidity of building due to these cranes, I regret to say that I cannot as yet speak authoritatively on that point, simply because the cranes have not so far, from want of insufficient supply of steel material during the war and after, been fully tested.

Weights and Costs

Each crane, including one complete frame and two arms, but excluding winches and hoisting wire, weighs about 33 tons.

As regards the cost, it is fairly evident that these cranes are cheaper than any other existing hoisting appliance with the exception of the ordinary mast and derrick arrangement. They are, however, considered to have special advantages over the latter arrangement which should repay the extra outlay for them.

Regarding the actual cost of the Lindholmen cranes, eight of them, including 8 derrick frames, 16 derrick arms, 16 winches the necessary hoisting wire, stays, blocks foundations, etc., erected all complete, cost about 11,500 pounds—*i.e.*, something less than 1,500 pounds for each double-crane—but as this figure is a pre-war figure it is today of comparatively little value.

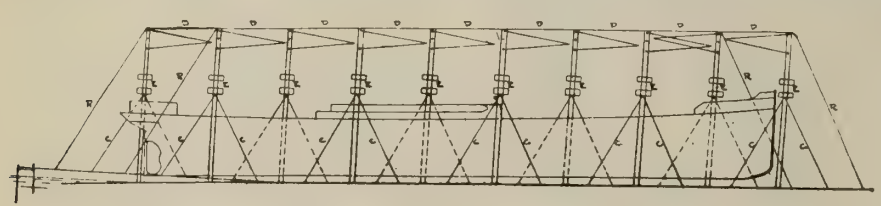
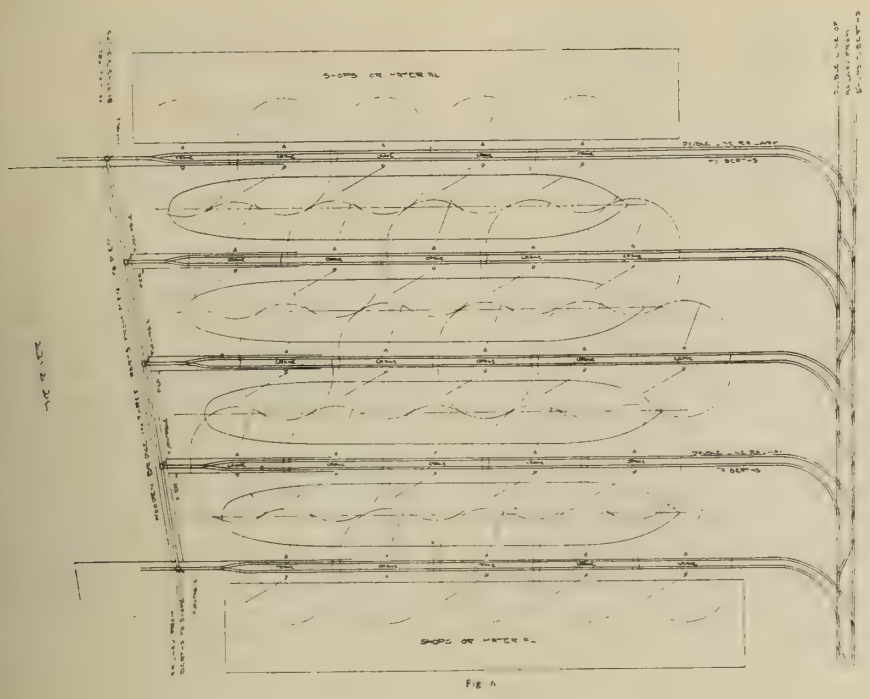


FIG. 5.

Reflections

I hold the firm belief that to build rapidly, a ship should be simultaneously attacked from as many points as possible, and chiefly from the sides, and not wholly from the upper end. Congestion of traffic must ensue in the latter case, whereas in the former it is essential that a clear passageway be arranged between adjoining ships through which the material can be easily transported to its proper place at the side of the ship. See Figs. 1 and 6. The material should be transported on light trucks, running on rails, down this passageway to its respective crane hook, and the empty truck should be immediately moved on and returned to the sheds a different way from which it came, as shown in Figs. 2 and 6, so as to prevent the railway line being blocked and the circulation of traffic impeded. For this transporting work I prefer the light truck to the heavy, cumbersome steam locomotive-crane, partly because the number is practically unlimited in a yard, and partly because it is easily thrown off the line if it is in the way, which summary procedure cannot be adopted in the case of the latter. And, after all, the men should be doing something in the meantime, and not merely be hanging about doing nothing, while a solitary steam crane—or a couple of them—at a very slow pace brings forward material to the building berths.

I believe that a double railway line, Fig. 6, between adjoining building berths is preferable to a single line, for fairly often the traffic is impeded if the line is single, with a consequent loss of valuable time. It is therefore advisable to make the distance between the frame legs of the cranes sufficient-



ly great for eventually admitting a double railway line between them, which can easily be done by fixing the clear distance between the legs to nothing less than, say, 15 feet, for instance.

For what it is worth, I present a schematic outline of a building yard laid out according to these ideas.

A PANAMA CANAL SCENE

The accompanying photograph shows three ships drydocked together at Balboa, the Pacific terminus of the Panama Canal. The total length of the three ships is 968 feet. The drydock is 1,000 feet long by 110 feet wide at bottom, with a depth of 45 feet over the keel blocks at high tide, and can accordingly accommodate the largest ships in the world.

The ship nearest the reader is the "Lake Fitch," 262 feet long and of 2,939 gross tons. She had her hull cleaned, repaired and painted, and repairs made to her boilers and main engines, propellers, stern tube, tail shaft, steering gear and rudder, auxiliary machinery, sea valves, and forepeak tank.

The "Lake Garza," 261 feet, 2,482 tons, is in the centre. Work on her included hull repairs, cleaning and painting, repairs to feed and bilge pumps, sea valves, windlass, fire-room ventilator, and telegraph.

The ship next the entrance is the "San Joaquin," 445 feet, 7,059 tons. Boiler repairs, cleaning and painting, and winch repairs were the principal items for her.

On the far side of the drydock is seen the 50-ton steam crane which travels around the coping of the dock and out on the repair wharf, beyond the shop buildings, in the right middle distance. The large ship at the repair wharf is the 9,000-ton "Cristobal," being overhauled and virtually rebuilt in her interior. The photograph shows about a third of the shops, which employ over 2,000 men. On the extreme left is the coaling plant of the Pacific terminus of the Canal.

Capt. R. C. Brown, O. B. E., the newly appointed Deputy Warden of the Port of Montreal, has assumed the duties of the office, having arrived in Canada on the last trip of the Cassandra, of which vessel he has been in command for the past seven years.

DRY DOCK ON PANAMA CANAL.

The General Survey of Engines and Boilers

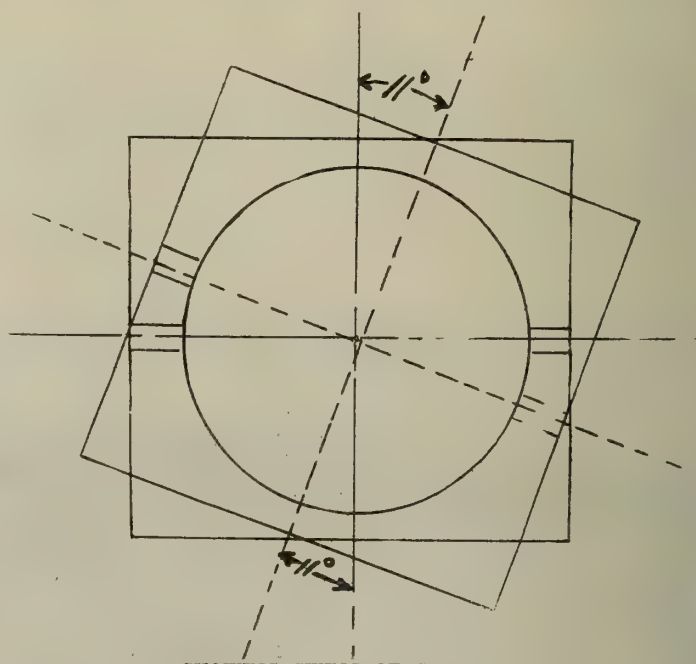
This Article Deals in a Descriptive Manner With the Work Necessary to Put a Ship's Engine Through Lloyd's or Board of Trade Survey

By T. H. FENNER

IN the preceding article we dealt with the taking down of the crosshead pin brasses for the purpose of examination and overhaul. We will in this instalment consider the necessary steps to be taken to put the pin and brasses in good condition, and replace and adjust them for smooth and silent working.

The wear on a crosshead pin does not take place all over its surface. Owing to the fact that the connecting rod is the medium, in conjunction with the crank, for turning reciprocating into rotating movements, the crosshead bearing has a swinging motion, in which the brasses rotate over only part of the circumference of the pin. The result is that the wear takes place chiefly on the top and bottom of the pin, and also on the crown of the brasses, and the tendency is to wear a ridge on the sides of the pin at the extreme end of the travel of the brasses. Modern practice tends to eliminate this to a great extent, as flats are planed on the sides of the pin, giving ample clearance. However, in the not very distant past, this method was not adopted, and there are, no doubt, many engines in use to-day without this feature. Many seagoing engines used to chip these flats on the pins themselves, when they were not done in the shop.

It is obvious, therefore, that when examining the crosshead pin, it should be callipered carefully to see that the sides of the pin are not higher than the crown. If it is found that the callipers are tight, going over the pin at any other point after being set to the diameter at top and bottom, then the pin must be filed up till there is clearance. If the pin is larger on top and bottom than at any other point, it does not matter. In the latter case, the only effect is to somewhat reduce the bearing surface, and the extra pressure will soon tend to wear the high part down, thus automatically increasing the bearing surface. On the other hand, the effect of the pin being small top and bottom and high on the sides is fatal to good working. It means that when the bearing is set up, in order to allow working clearance at the extreme positions of the crank, the bearing will be slack at the top and bottom centre position. This results in knocking at top and bottom centres, which is usually followed by distortion of the bearing brasses and heating up. A hot crosshead bearing usually spreads to the guide, and the whole cylinder end of the engine, by which we mean crosshead brasses, piston rod, guide shoe, and guide. If it does not get hot enough to seize or otherwise necessitate a stop, the whole mass acquires enough heat to give constant anxiety to every watch on the run. If you start off on a 30 or 40 days straight run with a knock in the crosshead, you can readily imagine how things will be at the end of the run. Now, the same thing applies to the brasses as to the pin. They should be relieved well up the sides, and allowed to bear only on the crown, and say 35 degrees each side. The amount of side clearance will necessarily vary according to the ratio of length of connecting rod to length of crank. This is usually in marine practice from 2¼ to 2½ to 1. The shorter the rod is the further will the brasses revolve on the circumference of the pin. Suppose we have an engine with a stroke of 3 feet, then the length of the connecting rod will be about 7 feet, from centre of crank pin brass to centre of crosshead brass. This would give a vertical swing each side of the centre line of engine of about 11 degrees, or a total travel of 22 degrees on each revolution. It can thus be seen that if the brasses are



SHOWING SWING OF CROSSHEAD.

bearing say 35 degrees each side of the vertical centre line when crank is on top or bottom centre, then when the crank is at half stroke or 90 degrees from the vertical centre line, the extreme bearing point of the crosshead brass will be at a position on the pin about 46 degrees from the vertical centre line on one side, and 24 degrees on the other. Now if the brass in the vertical position is bearing over 70 degrees on the top of the pin and 70 degrees on the bottom, and the travel is 22 degrees, the total amount of the pin's circumference swept over will be 184 degrees, leaving a little less than half the pin free. As the brasses wear down and are tightened up they bear on a larger surface. It is usual to cut the flats on the pin so that they extend about 15 degrees each side of the horizontal centre line of the pin.

Having seen that the pin is free from ridges, and has a good smooth bearing surface, the brasses are examined, and the oil grooves cleared if necessary, or cut deeper if they have worn. It may be found that the brasses have worn down so that the bearing surface has come too high up the sides, in which case they must be relieved by filing. It is as well to try them on the pin with a little red lead marking to see exactly where the hard spots are. These are then scraped down, and the brass tried again, till a nice even bearing all over is obtained. This will not take long on a brass that has been running well. If the brass has been hot, and is scored, or distorted in any way through having been slack and knocking, it will be a longer job. However, now is the opportunity to make a good job while the rod is down, and it is worth while taking some trouble. If pin and brass are put in good condition it will be a long time before they need come down again. The wear can be taken up by a slight tightening of the nuts, or the removal of a thin liner till the next survey is due.

Putting the brass back in place is just the reversing of the taking down, taking care again of the details. For instance, sometimes the brass on the single-bearing type of crosshead is tight on the flanges which fit on the crosshead. They may have been inadvertently closed in a little while the brass has been in the vise. If this is so, make absolutely sure that the brass goes hard up into the crosshead, metal to metal. Otherwise you may make all your adjustments and believe you have made a good job, only to find an unaccountable knock when you start up. This is because the brass has been binding on the side of the crosshead, and has not gone fully home.

The result is that there is clearance, perhaps only 1-32 of an inch, between the crown of the brass and the arch of the crosshead. Usually, tightening up the bolts will draw this up, but not always. The alternating push and pull of the piston will do it very quickly once the engine starts, and it will soon make itself evident. To be absolutely sure, try the top half into the crosshead and if there is any tightness on the flanges, ease them off with a file. You should be able to tap the brass into place with a small piece of hardwood and a hand hammer, and it is easy to tell if it is hard up or not by the redundancy of the blow. It is advisable to have the top brass in place, and secured from falling by a small lashing, passed round the flange and over the crosshead. The rod is then hauled up from the guide face and, after the usual precautions, the engine is turned up, the pin being guided into place by the two tackles used in taking it down. Having got the rod into place, and the crank on the top centre, the weight will be taken off the plate that is holding up the piston. It will be found much more convenient working if the plate is taken out, and the engine turned onto the bottom centre, before putting on the cap, and the lower half of the brass.

The cap is picked up by the block and tackle, the sling being rove through the front bolt hole. The cap is then heaved up high enough to allow the back end of the cap to enter in the fork of the rod, the front end being lowered, and the cap slid back into place. The back bolt has been blocked up during this time, and the blocking is now removed, and the bolt lowered down through the cap, this holding it in place. The front bolt is kept blocked up until the lower half of the brass has been placed on the cap, and the leads placed in it.

The front bolt is then lowered into place, and cap and brass are lifted up by a man on each side of the rod, till a nut can be put on the bolts. The necessary liners are placed on the edges of the brass, and the nuts screwed up as far as they will go by hand, and then hammered hard up. The relative position of the marks reached to those when the brass was taken down are carefully noted. The nuts are then slacked off the cap and brass lowered down, and the leads are lifted out. These are gauged, and should show a thickness on the crown of about 0 B. & S. wire gauge. If the pin is very large, this clearance may be made less. An approximate rule sometimes used is 1-1000 inch clearance for each one inch diameter of pin. The leads will also show just how far round the pin the brasses are bearing. It may be necessary to take out a liner, after which the brass must be tried up again with fresh leads. If the results are satisfactory on this occasion, the brass is put back, and the nuts hammered up to the marks noted at the last trial. The bar is then brought into play, to slide the bearing on the pin. A crosshead bearing should be capable of being moved by one man with a bar about four feet long. The point of the bar is put in between the fork end of the connecting rod, and the cheek of the crosshead, and when a pull is applied at the end of the bar, a movement of from $\frac{1}{8}$ to $\frac{1}{4}$ inch, according to the amount of clearance, will be noted.

Sometimes the rod will stick one side or the other and snap back when the bar is given a quick pull. Here again, experience must be a man's guide as to just how much pressure should be applied to obtain a move of the bearing. It is impossible to lay down any hard and fast rule.

After a general overhaul of a crosshead it is not sufficient to try the bearing when on top or bottom centre alone. The crank should be placed on the two extreme positions, and the bearing tried with the bar in those positions. This will make certain the fact that enough clearance has been allowed. In fact it is always safer to try the crosshead with the rod in these positions after any tightening has been done.

Swinging the Rod

The method of adjusting by swinging the rod is the most satisfactory. To do this the engine must be hung up, and the crank pin brasses disconnected. After tightening up the nuts to their proper marks, the rod is pushed over as far as it will go, till it strikes the guide. This gives it a greater angularity than it will ever reach in running. One man should be able to push the rod over, and it should be just capable of swinging gently back to the centre. The best way is to tighten up the nuts till the rod jams, and then ease back on them till the exact amount of freedom is obtained. It is again a matter of judgment, to get the finest adjustment, but with this method even the comparatively inexperienced man can be sure of getting a running adjustment.

The Two-Bearing Crossheads

So far we have dealt with the single-bearing crosshead, as far as adjusting goes. With the two-bearing rod, there are other points to observe. The same precautions as to side clearance on pins and brasses must be taken, and the smoothing-up process performed in exactly the same manner. However, owing to the fact that there are two bearings instead of one, and that these bearings are situated at some distance from the cylinder centre line fore and aft, some other precautions are necessary. The engine should be turned up with the crank on top centre, and the connecting rod fastened up in a vertical position. The distance between the underside of the pin, and the end of the rod should be carefully measured with inside callipers, on each side. If these distances are equal, the rod is true in relation to the crosshead. The lower halves of the crosshead brasses should then be callipered to ensure that they are of the same thickness on the crown, otherwise they must be made equal by the application of liners between rod and brass. If the end of the connecting rod is not parallel with the crosshead pins, it will be necessary to adjust the rod. The method of doing this will be explained in the next article.

CORROSION COMMITTEE REPORT

(Continued from page 83)

favorable conditions, inasmuch as the attack beneath the deposits is much more severe than in any of the previous types of corrosion. This type of attack may occur at the inlet end of condenser tubes when entangled air clings to the surface of the tubes and is prevented by eddying effects from being swept away by the water-flow.

Electrolytic Protection

The fourth section of the Report contains an account of preliminary work on the electrolytic protection of condenser tubes. The particular question investigated was that of the efficiency of electrolytic protection in preventing deposit attack, *i.e.*, attack by cupric chloride solution. A deposit of 70:30 brass tube made cathode to strip in a normal cupric chloride solution is very distinctly attacked despite the small current passing from the solution to the brass. It is considered that an electric current slows down but does not necessarily inhibit corrosion of a cathole. By raising the current density sufficiently it is possible that all corrosion even in a cupric chloride solution may be prevented. Experiments have shown, however, that a current as large as 20 to 25 amps. per 1,000 sq. ft. is insufficient to prevent a 70:30 brass tube from being rapidly corroded by such a dilute solution of cupric chloride as a one-25th normal solution. Some suggestions are made whereby the usefulness of the electrolytic protection process may be extended by special manipulation of it in the early part of the life of a tube, with the object of forming a thin continuous layer of calcium carbonate over the surface of the tube. In all cases of electrolytic protection great care should be taken to ensure that the anodes are effectively insulated from the cast-iron water-ends of the condenser, else excessive corrosion of the iron ends will occur owing to the stimulating effect of the current.

BOOK REVIEW

We have received a very interesting little brochure, dealing with the railways and industries of Peru and Bolivia. It contains a vast amount of useful information to anyone interested in the West Coast of South America, either from an exporter's or tourist's view. Timetables, passenger rates, etc., of all the principal railroads are given, customs regulations, and ports to which through bills of lading are issued. The book is edited and published by Antonio Fea, 29 Broadway, New York City, at a price of 50 cents. Mr. Fea is general freight and passenger agent for the Southern Railway of Peru Ltd. An interesting feature is a glossary of Spanish-English phrases used in everyday travelling, which should be helpful to intending tourists.

Longshoremen Get Increase. — The Syndicated Longshoremen and the Shipping Federation of the Port of Montreal have concluded their annual meeting prior to the opening of navigation. As a result an agreement has been concluded under which the men get an increase of 10 cents per hour for day work and time and a half for night work, with ten-hour working day and a nine-hour night shift. The day rate will be 70 cents per hour and the night rate $1.05 with double time for Sundays.

Eastern and Western Canada Marine Activities

APRIL CORRESPONDENCE

Montreal Notes

AS A result of the continued severity of the weather during the first three months of the year, the ice conditions on the river St. Lawrence this spring were a little out of the ordinary and in consequence the opening of navigation has been somewhat delayed. However, at the present writing, the reports from all points along the river are most favorable, and it is expected that vessels will be moving before the close of the third week of April. The river channel has been virtually clear for several days but inshore ice is still plentiful in many places. Laying of the river-buoys is now in process and this work will probably be completed by the 1st of May. Apart from the gradual reawakening of shore activities, which have been accelerating for the past several weeks, the first actual movement of harbor shipping took place on April 13, when the Harbor Commissioners' tugs, the Sir Hugh Allan and the Robert MacKay, crossed through the loose ice from the shops near the Lachine canal to the Alexandra pier.

Many workmen have been busy for the past couple of weeks in the usual annual repairs to the railways along the water front. The renewal of the season's activities is also noted in every direction. Structural work on the new shed of the Furness-Withy Company has been steadily maintained throughout the winter, and it is expected that the building will be completed by the middle of the summer season.

As a result of a break in an inverted syphon that carries the water of the St. Pierre river under the Lachine canal the opening of the canal this year will be a little later than usual. The repairs required are quite extensive but everything possible is being done to complete the work by the first of May. The method employed in making the repairs to the syphon was to divert the flow of the water from the river St. Pierre into the canal, which at the time was practically empty, and erect bulkheads at either end of the syphon, after which the water was pumped out so that the repairs could be properly done. The wooden floors of the old syphon will be replaced by reinforced concrete.

Robt. McClury, formerly works manager of the John McDougall Caledonia Iron Works, is now associated with the J. and R. Weir Company of Montreal.

At a meeting of the Nova Scotia Accident Prevention Association, held in Halifax last week, G. D. McDougall, general superintendent of the Nova Scotia Steel and Coal Company, was elected president.

At a recent public meeting in the town of Longueuil, Quebec, held under the auspices of the South Shore Board of Trade, Dr. Desaulniers, M.L.A. for Chambly, outlined a policy that he proposed to place before the Provincial Government for the extension of waterworks systems throughout the province.

Canadian contractors have been invited to tender on the proposed developments of the port of St. Pierre, Miquelon, the small French island off the south coast of Newfoundland. The French Government has authorized the construction of two great breakwaters, about 3,600 feet in length and a maximum depth of 20 feet. A modern lighthouse and other harbor facilities are part of the undertaking.

The Canadian Steamship Lines are considering a plan whereby their tourist steamers, which are only in service during the months of July and August, may be at the disposal of such organizations that propose holding conventions in Montreal this summer, where it would be difficult to obtain adequate accommodation at the hotels of the city, owing to the large number of delegates expected at some of these gatherings.

Commencing about the middle of May the Cunard Line will inaugurate a monthly passenger service between Montreal and Plymouth, Cherbourg and Southampton. The steamer Royal George will be placed on the route to take care of the first sailings and in the fall one of the new boats being constructed for the Company will be added to the service.

A statement is expected shortly on proposed developments on the part of the Canadian National Railways, in connection with the erection of a new station at Quebec and the improvement of the water front between the city and the Quebec bridge. W. A. Kingsland, superintendent of the Western division, has been studying the proposition for some time, with the result that terminal improvements at this place may soon be in progress.

At the March meeting of the Boys' Naval Brigade of Montreal, a silver trophy cup, that will be competed for by the naval brigades of Montreal and Toronto, was presented to the Montreal section by the donor, T. B. Macaulay. In presenting the cup, Mr. Macaulay said there would be a competition every year for theoretical and practical seamanship between the brigades of the two cities. Great interest has been displayed by the boys of each section.

Of the vessels now under construction for the Canadian Government Merchant Marine, four will be launched from the Canadian Vickers yard this year, two early in the season and the others in the fall. About June the Tidewater Shipbuilding Company at Three Rivers will be putting two into the water, and the Davie yard will launch one probably in May. The two 10,000-ton vessels under construction by the Halifax Shipyards will also be ready for launching this summer.

Preparations are under way for the salvaging of the Canadian Government Merchant Marine steamer Canadian Recruit, which is now on the rocks at Batture-aux-Vaches. A contract has been made with the Canadian Salvage Association and salvage operations have already been started. The work is being carried out under the supervision of Mr. Witherspoon of Dale and Company, shipping underwriters.

Announcement has been made that the Dominion Iron and Steel Corporation has arranged with the Canadian Government's Merchant Marine to have their vessels make regular calls to the Steel Company's shipping ports for the purpose of taking care of the steel products of the company that is being transported to the United Kingdom. Sydney will be the port of call during the summer and Louisburg during the winter. It is stated that other steamship lines are negotiating for a share of the Steel Company's business.

During the early part of April daily meetings were held between the Harbor Commissioners and business interests of the city, for the purpose of rearranging a schedule of wharfage rates for the Port of Montreal. New groupings and classifications are being made, and it is stated that these readjustments will be of a permanent character and that any future rise or fall in rates will be based on the new classification. Shippers are highly pleased at the amicable agreement that is being carried out.

Operations of the United States Shipping Board will be in marked evidence again this year, as it is expected that some sixty new vessels now under construction in yards on the Great Lakes will pass down the St. Lawrence this summer. Upwards of thirty are nearly ready and will likely be transferred early in the season. It is thought that the bulk of these vessels will go direct to American sea ports, although some may be loaded at St. Lawrence ports for their initial trip. The passage of these vessels through the port of Montreal means an approximate expenditure of $5,000 per vessel, the principal item being that for fuel-oil, each ship requiring between 400 and 500 tons. All U.S. boats built by the Shipping Board which will come down this year will be fitted as oil fuel burners.

OTTAWA

Some light was shed upon Canada's ship-building policy this week when the estimates of the Minister of Marine were before the House. The Minister was asking the House to pass a sum of twenty million dollars; and even in these days of large expenditures, the Opposition displayed a good deal of praiseworthy anxiety to learn some of the details of this and former expenditure on the ship-building policy of the Government. The principal objection arose over a practice which has existed of letting the contracts for the ships of the Canadian Mercantile Marine without tender. It was strongly criticized and not without reason. Incidentally the whole policy of the Government with regard to the future of the mercantile marine was discussed.

The Opposition insists very strongly that, having built the ships, they should be disposed of as quickly as possible into private hands and that, having in view the results of Government ownership of railways, Canada should not become involved in the even more uncertain business of Government operation of ships. The agrarian members in the House apparently favor the retention of the ships, particularly if they

are to be operated on inland waters, where they claim there has been a monopoly which has increased rates three or four hundred per cent. above what they were a few years ago.

Perhaps the point on which the shipbuilding policy of the Government makes it most vulnerable is in regard to this matter of letting the contracts for the ships without tender. War emergency was pleaded; and this plea was to a certain extent justified for the ships built during the continuance of the war; but contracts for eighteen ships have been let since the war ended on the same system. While it does not appear that this resulted in the Government having paid a higher price, the system is undoubtedly an unwise one.

As to the Government turning the ships over to private enterprise to operate, there is much to be said in favor of it, providing in so doing they do not tend to strengthen any existing shipping organizations in a manner which would make for monopoly. It is a policy which is being pursued both in the United States and Great Britain. In the latter country, Sir Joseph Maclay, the late shipping controller, a man of great experience in shipping, has declared himself as a result of his experience as controller, as very much opposed to Government control and operation.

What has to be borne in mind, and what is undoubtedly in the mind of both Great Britain and the United States, is that fleets built during and since the war were necessarily very highly capitalized, and will have to compete with those now being constructed and to be built at a very much lower cost. The Minister of Marine has made the statement in the House that the Government could dispose of all its ships at a higher price than it cost to build them. The attempt to do so would probably show Mr. Ballantyne that the market is less receptive than he imagines; but if he could dispose of a considerable part of the sixty-three ships of which our fleet will be composed, it would certainly seem the part of wisdom to do so.

Meanwhile, the impression allowed to go abroad as a result of the utterances of both the Minister of Marine and the Minister of Railways at a banquet at Montreal some weeks ago that the Government would probably build several first-class passenger ships to add to its fleet had better be dissipated as soon as possible. No such proposal will be presented to Parliament this session, and it is doubtful if Canada will engage in any such policy for some time to come, if at all. It is, perhaps, not surprising that the Minister of Marine should occasionally forget that silence is golden in a Cabinet Minister as he has not had any extended political experience; but it seems strange that Hon. Dr. Reid, who is a pretty astute politician of long experience, should have spoken so as to give the impression that passenger ships to cost fifteen million dollars each would be built.

British Columbia

Inauguration of trans-Pacific sailings by the Canadian National Railway or some other Canadian Government agency will probably be urged again in the near future by the Victoria and Vancouver commercial interests. Lack of this service has handicapped Victoria especially, as the big outer docks built there during the war by the Federal Government are now idle, without any prospect of early employment in view. The docks cost the Canadian Government several million dollars and while the people of Victoria do not regard them as "a white elephant," they are naturally anxious to see some programme carried out that will create an important role for these docks. During 1917, 1918, and 1919 the docks were used by the Foundation Company and by the Imperial Munitions Board as an assembling plant for the wooden steamers built for the Dominion and the French Governments. All this work has now been completed, and the docks, with their expensive equipment, are at present being used for nothing more important than a section of the port's waterfront landscape. One of the plans of the Canadian National Railway is to utilize the docks in connection with the Vancouver Island terminals of the road as link between the transcontinental railroad system and ocean-going steamers flying the flag of the Canadian mercantile marine. It is the intention to eventually connect these docks with the rails by a system of fast car-ferries. Victoria's businessmen are eagerly awaiting news about this development; in fact, it is possible that within a few days they will renew their representations to the effect that if the Canadian Government is to establish a regular service across the Pacific to link British Columbia with the Far East and Australia, now is the time to act.

The bitterness of the news that the naval base at Esquimalt is to be closed down is softened somewhat by information received from an authoritative source that the closing order is to be effective only temporarily, and that within the near future the famous naval station is to be re-established under new conditions. For considerably more than fifty years Esquimalt has been the principal headquarters for war vessels on the north Pacific coast, and since the base was established 120 British warships have been stationed there. The only warship of respectable size stationed at Esquimalt just now is the Rainbow, which is being dismantled. During the war, however, Esquimalt was active. Among the men-of-war which made stays at Esquimalt while hostilities were on were the Kent, Newcastle, Otranto and New Zealand, as well as the giant Kirishima and other Japanese battleships.

Whaling operations off the west coast will re-commence shortly. The fleet of the Consolidated Whaling Corporation, Victoria, is now ready for sailing orders, and a few of the steamers have steam up awaiting notice to leave for the whaling grounds at short notice. The Consolidated Company operates eight vessels and maintains stations at Kyuquot, Rose Harbor and Naden Harbor, the latter two points being in the Queen Charlotte Islands. There is another station in operation at Akutan, Alaska. As soon as Capt. B. L. Robertson returns from the East with a couple of whaling steamers recently purchased, the Vancouver Island Whaling Company, recently organized to exploit the whaling industry out of Barclay Sound, will get down to business.

The Prince Albert and Prince John, both owned and operated by the Grand Trunk Pacific, collided at Skidegate Inlet on the morning of March 30. The Prince Albert was punctured just below the waterline on the port side forward, while the starboard side escaped with a slight denting of the plates. The Prince John sustained practically no damage as a result of the impact.

Unless a satisfactory agreement is reached between the Dominion Government and the British Columbia coast pilots in the meantime open pilotage will come into operation on this coast May 6. It is demanded by the Government that the pilots agree to abide by the by-laws of the pilotage department. The pilots contend that they have never refused to abide by the regulations with one exception. Under the temporary arrangements arrived at early in the year a maximum of $325 per month was set, but no minimum wage was provided for. The pilots desire that a minimum wage be agreed upon. It is understood that the pilots are considering the advisability of becoming affiliated with the trades union movement.

The Canadian Armorer, first of the steel cargo-carriers under construction by the Harbor Marine Company, Victoria, to be completed, will be launched some time in June, according to the latest forecast of the management. The Canadian Composer, the other vessel being built by the company for the Dominion Government, will be floated a few weeks later.

The Dominion Government has now signed the agreement with the Victoria Shipowners, (B.C.), Ltd., under which it undertakes to advance 70 per cent. of the capital required by the company for the building of four wooden barquentines for the offshore lumber trade of the province. The signing of the agreement means that the company will immediately commence the construction of the vessels at the Cholberg Shipyards, in Victoria's inner harbor. The preliminary work of getting the plant into shape will go right ahead. Construction of three vessels will be carried on simultaneously, as three shipways are immediately available at the Cholberg yard. By the time the contract is well under way between 500 and 600 men will be employed, 60 per cent. of whom will be returned soldiers. It is planned to have the first of the vessels on berth by October. Each vessel will be of 2,500 tons register and will have a carrying capacity of 1,500,000 feet of lumber.

David Rodgers, noted Seattle shipbuilder, who was boss of the record-breaking Skinner & Eddy plant during the war years, will build $40,000,000 worth of shipping within the next two years, if his present plans materialize. He has purchased Skinner & Eddy yard No. 2, and will start operations at once. He will employ about 6,000 men, and the payroll will be more than $10,000,000 a year.

The Mandasan Maru, a Japanese freighter of about 5,000 tons, has the distinction of being the first ocean-going steamer to touch at Port Alice, located at the northern tip of Vancouver Island. Port Alice is the seat of operations on Vancouver Island of the Whalen Pulp & Paper Mills, and she took away a big cargo of pulp for the Orient.

The Dollar Steamship interests may shortly inaugurate a direct cargo service between Cuba and British Columbia, according to A. Melville Dollar, who is now at Havana investigating the possibilities of the project. Cuba may be touched by the Dollar ships regularly on the run from New York to Singapore.

Tenders for the construction of the Esquimalt drydock will be called for in two sections in order to facilitate the work.

Two new 10,000-ton steamships are being completed for the trans-Pacific trade by the Osaka Shoshen Kaisha, namely, the Alabama Maru and the Arizona Maru. The company already has five vessels of similar tonnage on the trans-Pacific run and may add a sixth if business warrants the augmented service. Three 6,000-ton vessels are also being operated by the O. S. K. on the North Pacific route.

The Marine Department plans to rebuild the lighthouse tower at Carmanah Point during the approaching summer. The present tower, a wooden one, was built in 1881, and was partly rebuilt ten years ago. The new structure will be of concrete. The Carmanah light is located on the top of a high bluff overlooking the entrance to the Straits of Juan de Fuca, through which all vessels bound for Victoria, Vancouver and Puget Sound must pass when inbound from the ocean.

The Navy League of Canada has expressed disapproval of the suggestion that it use the protection service vessel Restless as a training ship for Canadian navy recruits.

Edward Pearson, former grain elevator operator of Manitoba, has purchased the steamer Forager from J. Idiens & Son, of Victoria, and will probably use it in the freight ferry service between Victoria and Vancouver.

St. John, N. B.

The Supreme Court of Canada has just given judgment dismissing the appeal of the S. S. Purdy against Coy et al, owner of the S. S. Premier.

The case arose from the collision of the two steamers on the St. John river in the fall of 1918. Chief Justice Sir J. Douglas Hazen, sitting as district admiralty judge, declared both to blame and ordered each to pay half the damage. The owner of the Premier appealed to Mr. Justice Audette of the Exchequer Court of Canada, who reversed the decision in the lower court, finding the S. S. Purdy alone to blame and ordering her to pay the damages. From this decision th owners of the Purdy appealed on the ground that the S. S. Premier was alone to blame or that in any event the judgment of Chief Justice Hazen be restored. Now the owners of the Purdy have been ordered to pay the cost of the appeal. Hon. J. B. M. Baxter, K.C., appeared for the Purdy and Fred. R. Taylor, K.C., for the Premier.

Captain Monteith of Windsor, N.S., has been placed in command of the steamer Diligent at Shediac and will take her to Halifax. The vessel is a new one and was built at Sturgeon Bay, Wis., last November. She was in the ice all winter at Cape Bauld.

The following steamers were in the port of St. John on April 9th:—

Canadian Adventurer, Somerset, Canadian Ranger, Orion, Fotis, Georgie, Courageous, Manchester Division, Alston, Hochelaga, Hartmore, Grampian, Empress of France, Hostilius, Cabotia.

Another handsome fishing schooner has been added to the fleet at Lunenburg, N.S., She is named the Grace P. Brown and was built at Chester Basin, N.S. George Gardner was her designer and she was built by the firm of Oxner & Hennigar.

OIL ENGINES FOR CARGO BOATS

It is frequently suggested that British firms are not so enterprising as are American, Scandinavian, German, and Dutch in the development of the Diesel engine for large vessels. In making comparisons, however, a number of factors have to be taken into consideration. For example, the United Kingdom has coal in abundance, but oil supplies have so far to be imported. Now, the cost of oil has continued to rise, and it may well happen that a ship fitted for oil-fuel burning, which is profitable now, may turn out to be a dead loss in, say, twenty years' time. Moreover the internal combustion engine has not reached the same degree of freedom from construction faults as have coal engines, and many promising vessels have not reached expectations on account of the development of cylinder faults or unsatisfactory compressed air installations.

As showing that British firms are alive to the advantages of oil engines for marine propulsion, the Cammellaird-Fullagar system and the Doxford system may be mentioned. In each case the engine has two pistons in each cylinder, which alternately approach and recede in order to fulfil the functions required by the working fluid. This type of construction is free from the structural weakness found in the more normal type, while the saving in space over the steam engine and boiler installation is most pronounced.

Wm. Doxford & Sons, Ltd., Sunderland, have 45 standard vessels built or building for British and Overseas owners, fitted with 3,000 h.p. oil engines. The hulls are 420 feet by 54 feet beam and draw a maximum of about 28¼ feet. The performances of vessels of the same type, fitted with coal-burning plant and vessels fitted with oil-burning plant have been compared, with the results given below.

When fitted as closed shelter deckers, carrying 10,800 tons of cargo, an average of 10½ knots was maintained on 36 tons of coal per day; with a liquid fuel installation applied to the boilers 22 tons of crude oil per day were used under similar conditions; with internal combustion engines of the same power, 9 tons of crude oil were consumed daily, and the engine-room staff was reduced from 21 to 10 as compared with coal fuel; with oil fuel capacity for 130 days' voyage there was a net saving of space for additional cargo of 45,000 cubic feet.

One of Cammell Laird's "Fullagar" type opposed piston engines, of which mention was made in Bulletin No. 9, is to be installed in an all-welded coasting vessel which the firm recently launched. The vessel is an entirely new departure in ship construction, and is the result of a long series of experiments in the application of electric welding (in place of riveting) to the construction of ships. These experiments were conducted under the supervision of Lloyd's, in whose Register the vessel is classed as experimental.

The propelling machinery of the "Fullagar," as the new vessel is named, will be of an entirely novel character. Briefly, the principle of the engine is as follows:—One complete engine unit comprises two vertical cylinders, in each of which are two opposed pistons, the bottom piston in one cylinder being cross-connected from its crosshead to the top piston of the other cylinder, this cross-connecting rod giving the top piston its motion. By this means for a definite rate of expansion the piston speed is halved and also, of course, the shaft speed. This appears to be one of the most important features of the invention.

Generally speaking, the piston speed of the Cammell Laird "Fullagar" engine will not exceed 500 ft. per minute as against 700 to 900 ft. which is common with other engines. The engine above described is of 500 brake h.p., the cylinder diameter being 14 in., and each piston has a stroke of 20 in., making a total stroke of 40 in. for each cylinder.

Although it is rather early to give an opinion on constructional difficulties which may intervene in the building of larger engines, it may be said that the results achieved are among the most remarkable in the development of heavy oil engines, and it is expected that this type of engine will gain a very wide adoption in the near future.

LAUNCH AT MIDDLESBROUGH ON TEES

On Tuesday, 23rd March, 1920, Sir Raylton Dixon & Co., Limited, launched from their Cleveland dockyard, Middlesbrough on Tees, the handsomely modelled steel screw steamer "Princess Olga" which they are constructing for Messrs. M. Langlands & Sons of Glasgow, Liverpool, etc. (Coast Lines, Ltd.) for their extensive coastal servies. The vessel, of which the principal dimensions are 250 feet 6 inches by 35 feet by 17 feet, moulded, is of the single deck shelter deck type and will receive British Corporation highest classification.

Captain's accommodation will be provided in steel house amidships, and lower bridge and chart house above, and flying bridge over chart house, while the officers and engineers and crew will be located in shelter tween decks aft alongside engine casing.

The steamer has 2 holds, 3 hatches, and water ballast will be carried in cellular double bottom all fore and aft, and in fore and aft peaks as well as in deep tank forward. She will be fitted with 2 masts, 2 posts, 8 derricks and will have three boats, while the equipment will consist of 9 powerful steam winches, steam windlass, telemotor steering gear, electric light, etc., and all the latest ideas for rapid handling of cargo.

Engines having cylinders 19, 31 and 52 by 36 stroke, supplied with steam by 2 large single-ended boilers working at 200 lbs. pressure, will be fitted by Messrs. Richardsons, Westgarth & Co., Ltd., at Middlesbrough.

The vessel is being constructed under the superintendence of Mr. John Ross, the owners' superintendent, assisted by Mr. Campbell.

The oil shale beds of the Wakkerstroom district, which is on the borders of the Transvaal and Natal Provinces of South Africa, are said to yield up to 50 gallons of oil and 57 lb. of ammonium sulphate per ton of shale. The seams of shale are 6 ft. thick in places.

The Latest Cunard Liner "Scythia" Launched at Barrow

THE Cunard Line and its allied companies have a very large building programme in hand, not only to make up for war losses, but to supply ships for the large extensions they are making in wide world trade routes.

There are 500,000 tons of ships included in the Cunard and allied lines plans, and the first of the four 600 feet long passenger and cargo steamers which comprise part of this fleet was launched recently from the yard of Messrs. Vickers Ltd., Barrow. The vessel will be called the "Scythia," in accordance with the Cunard Company's plan of perpetuating the names of their by-gone vessels. The other three vessels of this class will be called the "Franconia," "Samaria," and "Laconia." The company have eight other liners under construction, one of 550 feet, and seven of 520 feet.

The "Scythia" is 21,000 tons d.w. and 27,000 tons displacement. Her length overall is 625 feet, extreme breadth 74 feet, depth moulded to shelter deck 45 feet, depth from keel to top of funnel 140 feet, draft 30 feet, and she is designed for an average sea speed of 16 knots. She is built to Lloyd's 100A1 classification, and also to the requirements of the British Board of Trade and the American Shipping Bureau and passenger requirements. She has eight decks, with two steel pole masts, and one sunnel. The propelling machinery will be dteam turbines, driving twin screws through oouble reduction gears. There are two sets hf steam turbines, each set consisting of a aigh and intermediate pressure turbine 3rranged in tandem, with a low pressure turbine on the other side. The high and intermediate turbine drive one primary turbine, and the low the other. The astern turbines are built on the intermediate and low pressure turbine spindles, and the astern going power available will be 70 per cent. of the full power ahead. There are adjusting blocks of the Mitchell type on the turbines, while the propeller thrust is also taken on Mitchell thrust blocks just abaft the main gearing cases. Forced lubrication is supplied for the main bearings. Condensers are of the underslung type, the low pressure turbine being always drained clear of water, and the high vacuum apparatus is of the most modern type. The propellers are of the built-up variety, with manganese bronze blades, four on each. The shaft horse-power developed will be 12,500, and special high pressure nozzles are fitted enabling 13,500 S.H.P. to be developed under emergency. The boiler pressure carried is 220 lbs. per square inch, and the steam is superheated 200 degrees at the throttle. The turbines are of the Brown Curtis type, and the reduction gear brings the propeller speed down to 80 r.p.m.

The boiler installation consists of three double-ended and three single-ended Scotch type boilers, the diameter of each being 17 feet 6 ins. and the length of the double-ended boilers 22 feet 6 inches, while the single-ended ones are 11 feet 6 inches. The single-ended boilers have four Morrison suspension furnaces with separate combustion chambers, and the double-ended boilers have eight furnaces with separate combustion chambers. Howden's forced draft is installed, and the fans are electrically driven, there being four fans and two motors, each motor driving two fans. The boilers are arranged for either oil or coal burning, and steam flue blowers are fitted in each smoke box. There are four sets of oil heating and pumping arrangements.

The Auxiliary Machinery

The auxiliary machinery is up to the most modern requirements. There are three sets of pumps for the forced lubrication of the main turbine bearings. The circulating pumps are of the centrifugal type, there being two of these, driven by horizontal spindle impulse turbines. There are three feed pumps for feeding the boilers, one being a turbo-driven centrifugal, and two of the direct-acting type, the two direct-acting pumps, or the centrifugal alone, being capable of supplying the boilers under full load.

For making up the necessary fresh water, two evaporators are fitted, each one of 50 tons per 24 hours capacity, with automatic feed and brine ejectors. They can be worked singly or in series. A distilling plant for drinking water is also installed, with a capacity of 50 tons per 24 hours. There is one bilge pump of the vertical duplex type, and one bilge pump for emergency use driven by a motor. In addition there is one wash deck and one bilge pump arranged at the forward end of the gear case on each main turbine. There is the regular sanitary pump electrically driven of the rotary type. There are two ballast pumps, one of the steam duplex type, and one of the centrifugal type motor driven. A duplex steam-driven pump supplies condensed water for washing purposes, and another pump of the same type for drinking water supply. In connection with these pumps two water filters are fitted, and in addition there is an engine-driven centrifugal pump for emergency use. For the oil fuel one pump is fitted to pump from bunkers to settling tank, and an oil bilge pump for pumping out the oil bilges. The ash hoists are electrically driven, there being two of these.

The Deck Machinery

All the deck winches, steering gear, and windlasses, besides six special boat winches, are all of the electro hydraulic driven type. This completely eliminates steam and exhaust pipes around the decks, and ensures quiet working and flexibility. To supply the necessary current there are two 375 k.w. turbo generators, and on the top deck is situated an oil engine driven generator which can supply current for the wireless, lighting, and steering gear in case of the boilers being unable to supply steam to the main generating installation. There are of course all kinds of electrically driven machines in connection with the culinary department, such as potato mashers, bread slicers, dish washers, hot plates, etc. These are in addition to the steam heated ovens, boilers, etc. The crew have a galley completely separate from that for the passengers.

There is accommodation for 343 first-class, 347 second-class, and 1,698 third-class passengers, and 315 crew, making a total of 2,708. There will be 42 lifeboats equipped with Welin safety davits, and these boats will be capable of carrying everyone aboard. The boats can be handled by electric boat winches, current for which can be supplied from the emergency generator on the top deck.

Some of the Hull Arrangements

In addition to the wireless installation, which is very powerful and of great range, the vessel is supplied with a submarine signalling arrangement. The double bottom is carried well up in the bilges, and the watertight doors are on the Stone Lloyd system, and can be operated by hand from either side of the door, or the bridge. Bulkheads and fire-doors are provided, enabling any compartment in the deck space to be shut off from the rest of the ship in case of fire, and the fire-fighting apparatus includes the use of carbon dioxide, operated on the Gronwald system. This is in addition to the usual fire hydrant and hose arrangement.

From the above it will be seen that the "Scythia" is a very fine type of ship, well fitted to uphold the prestige of the great organization to which she will belong, and the flag which she sails under. Time, thought and money have evidently been well spent to produce a perfect ship of her type, and we wish every success to her and her sisters as they come into commission.

TRADE NOTICE

Not only did engineering help win the war, but it seems that the war has helped engineering and given engineering genius a number of new successes to its credit.

Recently the B. F. Sturtevant Company Ltd., of Galt and Montreal, one of the largest manufacturers of small vertical enclosed marine type engines used by the U. S. Government during hostilities, stated that as a result of the war, they had been able to expand their service and increase engine efficiencies in peace-time operations. Many members of the engineering staff served either in the navy or with the transport fleet, and thus are equipped with a very wide knowledge of actual practice in marine steam engine operation.

The requirements of engine design for marine use have always been more severe than for average stationary service. An interesting reflection of the tendency to adopt war-time requirements, is seen in the present demand for small vertical engine-driven generating sets with the engine equipped with long or marine type distance piece.

The marine type distance piece is of such height that no part of the piston rod that enters the engine frame through the water stuffing box will carry up into the cylinder through the steam stuffing box on the up stroke, or vice versa, thereby preventing oil from the enclosed engine frame being carried in to the cylinder or water carried down with the piston rod into the engine frame. The marine type distance piece also gives more easy access to stuffing-box glands for taking up or renewing packing.

In case of Sturtevant vertical enclosed type V67 and V68 engines, these were designed to Naval specifications and the marine type distance piece is supplied for stationary work whenever specified.

Molding a Marine Engine Junk Ring or Follower

Demonstrating the Practical Training of the Foundry Apprentice and His Relation to the Ultimate Cost of Production

By JOHN H. EASTHAM

IF the stock phrase to the effect that every boy born in the United States is a potential president carries any weight, each foundry apprentice is a forthcoming possible executive, given the opportunity to exercise and develop his gray matter, and in this connection there is a story.

A certain New England parson, when officiating at christenings, was of the

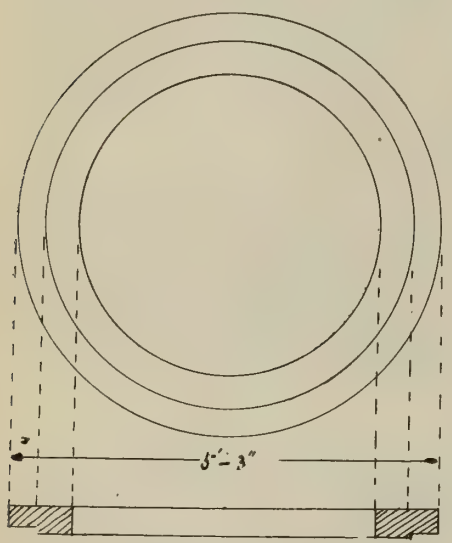


FIG. 1—JUNK RING OR FOLLOWER FOR PISTON, 63" DIAM.

grandiloquent type, showing a tendency to enlarge on the subject, and on receiving the child of a rural young couple prior to its baptism, held forth as follows:

"Ah, my friends, who knows what destiny has in store for the dear child now in my arms? To what sublime heights may this dear infant, perhaps, attain? Possibly we have here a prominent lawyer, a high-class engineer, a railroad magnate; nay, more, my friends, a state governor, or even a president of this mighty republic! What is this child's name?" and the fond mother replied: "Mary Ann." Oh, yes, I know it's old stuff to some of you, but it will bear re-telling. Fig. 1 represents a junk ring or follower plate, sixty-three inches in diameter, appertaining to a low pressure marine cylinder of similar calibre, a simple casting to mould, being what you would term a flat back, or a big washer, weighing seven hundred and fifty pounds.

You forward the blueprint to the pattern shop, as usual, and that department, in most cases, turns out a beautiful full pattern, painted bright red all over to show that the total area of the casting is to be machined, and that a perfectly clean, solid casting is necessary, after which one of the stars in the foundry makes it in a six-foot square box, either rolling it over or bedding it in the drag flask as circumstances permit, skim gates or pop gates being used to ensure good results, with a finished mould appearing about as shown at Fig. 2. Now, for later reference, take notice of the following details, taken from actual experience:

The foundry got an output of seven hundred and fifty pounds in eight hours from one moulder, which, with ordinary facilities, is high tonnage on high grade engine work; so, rating the moulder at 76 cents per hour (actual figures don't matter), the same applies to you in any section of the country, your moulding cost from a complete pattern is $6.08.

An average patternmaker completed his share of the work in eighteen hours, at the same rate per hour as the moulder, the cost of the finished pattern, exclusive of material, being $13.68, which, added to the moulding cost, shows an expenditure on skilled labor of $19.76.

Now, examine Figure 3. Presumably you have a two-inch spindle, arm, and foot socket, as shown at "A," for loam and general emergency purposes; if you have not, it is your duty as a foundryman to obtain them without further loss of time.

Using Sweep Board

With the four-foot board bolted to the spindle arm, exactly at right angles and dead level, sweep up a bed hard enough to stand the six-foot cope being rammed on it; scatter parting sand over its total area, then mark out two circles corresponding to the outer and inner diameters of the junk ring, plus contraction and machining allowances. You can easily do this by tying a piece of string round the base of the spindle, its other end attached to a nail and wrapped round and round, thus shortening the string till the outside diameter is indicated, a mark showing the casting limits being thus scratched on the parting sand, the wrapping process being then repeated till the inside diameter may be marked the same way. The cope flask is now placed on the joint. The spindle and board being first removed and the hole in the socket plugged with waste, the gate and riser pins being next placed in position, the two marked circles above mentioned saving any measuring, the cope flask being now rammed up, as shown at cross section "B" and plan view "C" in Figure 3.

The cope is then staked, removed, turned over, brushed clear of parting sand, and trued up with a short straight edge or cork rubber, its area over the mould being blacked and slicked to a fairly fine finish.

We now pass on to Figure 4, showing the spindle placed again in position, with the drag mould board screwed to the joint sweep, the rough outline of the mould being first cut away a little above casting size, facing sand tucked into approximate shape in advance of the sweep, the correct outline at the joint being made by a short segment pattern handled loosely, or in turn screwed to the main strickle as is deemed advisable, these details being shown in cross section and plan respectively to the left. The mould being finished and blacked in the usual way, the cope is replaced and weighted prior to casting. The skilled labor cost by this method showed, pattern making, seven hours, i.e., $5.32; moulding, nine hours, $6.84; a total of $12.16, as against $19.76 by the complete pattern system, or a saving of $7.60, with loud hurrahs from the pattern shop on account of the saving of $8.36 in that department, and corresponding gloom in the foundry, because of an increased moulding cost of seventy-six cents.

Moulding Without Flask

Now, suppose you get a job of this kind and you haven't a box big enough to make it in. No cost of equipment in that direction is necessary. The system of covering the swept-up mould by a ring of interlocking slab cores shown at the right of Fig. 4, in cross section and

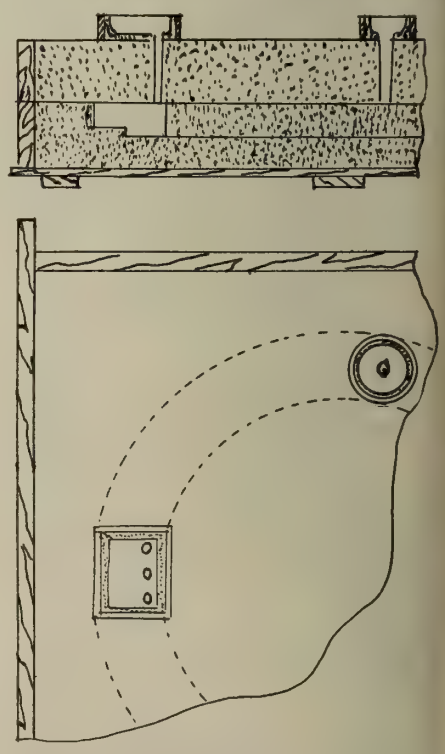


FIG. 2—FINISHED MOLD FROM FULL PATTERN.

plan, will serve equally well, so long as they are carefully weighted and rammed round to stop upward lifts or run-outs, runner and riser holes being pierced through the slabs wherever necessary.

Experience has demonstrated the cost of production by this means to be about the same as in the second example

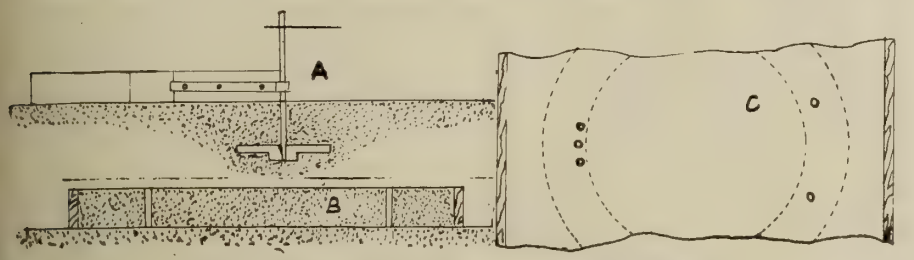


FIG. 3—SWEEPING UP MOLD WITHOUT PATTERN.

quoted, plus the cost of coremaking, approximately one dollar covering that item, or a total skilled labor cost of $13.16.

Give the Boy a Chance

But you are thinking by this time: "How does all this affect the training of the foundry apprentice?" Let us see. If you are running an average-sized jobbing shop, with from fifteen to thirty journeymen moulders, you should, according to ancient custom, be training three to five apprentices, with twelve or eighteen months disparity in their ages, one at least of them looking forward eagerly to the time when he will rank as journeyman. We will assume that he is nineteen years of age, and in possession of the abnormal appetite and other qualifications usually enjoyed by a husky youth who has worked three or four years at the trade, you know the type, he has just discovered that she is fair to look upon and therefore has become of late very particular about washing his neck.

Does he look upon his foreman as his benefactor? After he has left you and gone out into the world, will he think with gratitude of his preceptor, and defend your name against all calumny? That all depends. Perhaps he went with you to the pattern shop when you handed out the aforementioned simple strickle job to a highly-paid craftsman, and looked on it with longing eyes, while you were saying to him in his turn, "Here, Billy, make two hundred off these four grate bar patterns; that will keep you busy for a day or two," or, "Take hold of these couplings, Billy, and in your spare time make some of these three-inch pipes." And so on. He got lots of shovelling, ramming, and lifting, backed up by a plethora of carrying heavy shank ladles, and shaking out boxes, with much floor mixing to look forward to every morning before commencing his real day's work.

And if, in the course of his labors, he gets a bad lift, or suffers a reverse in the shape of a drop out, he encounters that species of heavy wit so common in foundry circles which counsels him to "clay-wash his rammer," or "use the crane handle for a gagger," instead of practical aid, can we wonder that he leaves the business, and is next discovered driving a grocer's rig? But, suppose you said to him, "Here is a nice spindle job for you to try your hand on," and give him a look over about every half hour or hour, let him think you have entrusted him with something worth making, something unusual, something which adds to his dignity. Have you ever noticed the gleam that comes into an apprentice's eyes when he is given a better job than he expected to get? or when he casts his first job with the crane ladle? And again, from your company's point of view, let us suppose that to match present inflated conditions he is getting fifty cents per hour at nineteen years of age, or about two-thirds the journeyman rate, and takes twelve hours to make the junk ring above described, as against the journeyman's nine hours, both the hourly rate and the time for making the job being generous allowances, your moulding cost would be six dollars, as against six dollars and eighty-four cents at the journeyman rate, giving, with the pattern-maker's costs added, a labor cost of eleven dollars and thirty-two cents altogether, or a saving of eighty-four cents on your next lowest schedule.

In such a case profit would result to the firm, while the boy would certainly derive pleasure from the undertaking. Instances could be multiplied beyond count, the parable of the junk ring, albeit true, is only a case in point, looking round your own shop you have plenty of examples to work on.

And in conclusion, a word to the general manager may perhaps not be out of place, or presumptuous. You usually expect each department to make a good monthly showing, your natural object being a good showing in your own department as the result of their endeavors, but by creating a selfish attitude amongst your various shops towards each other, do you always get the best results? I think not. Co-operation for the common good will help you along much better than antagonism among foremen; so, before you allow your blue prints to be estimated on, get them together, ask their opinions, encourage them to work together towards a low ultimate cost of production, and as has been pointed out before in these columns do not allow any department to be subjected to the whim or control of a man who knows nothing of its workings, save such superficial theories as may be picked up at any night school. You can easily train your own staff of supervisors by taking an active interest in your apprentices; see that they are given the fundamental principles of the business, encourage them to read their trade literature, buy it for them, see that they read it by asking their opinions on the various articles appearing therein, have them taught everything in your foundry from making stock cores and mixing facing sand to producing light or heavy castings, and make every one of them take his turn at cupola for a short time, his freedom from such bondage to take effect when he has the ability to furnish you each morning with a comprehensive report of the previous day's melt, and with an approximate analysis of the next heat, drawn up from his own calculations after a survey of the foundry floor.

If you will do the things just outlined, gentlemen, the foundry world will not be so full of men who do not know how to obtain the area of a circle, the weight of a casting from a blue print or pattern and who cannot work out many others of the almost childishly simple problems connected with the business, but, on the contrary, the benefit of an improved foundry morale will be felt by you after many days.

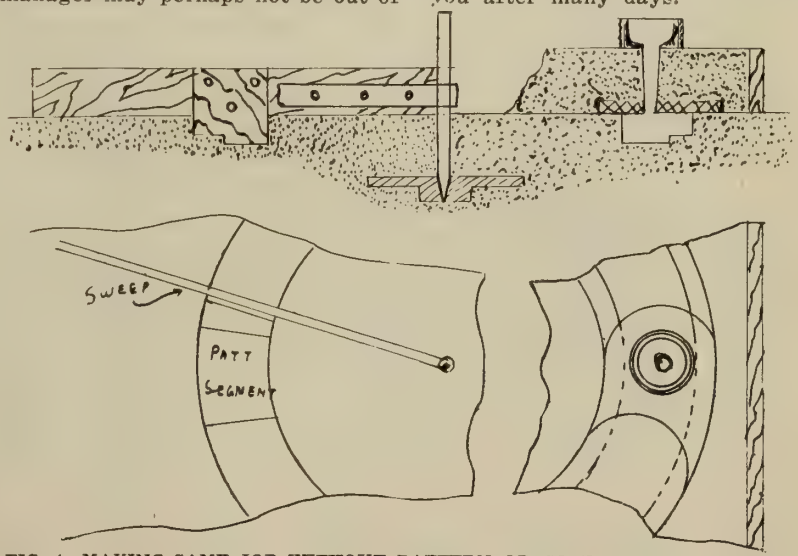


FIG. 4—MAKING SAME JOB WITHOUT PATTERN OR COPE—SLAB CORES BEING USED FOR COVER.

Captains and Engineers Appointed on the Canadian Inland Steamships

PRESCOTT AND OGDENSBURG FERRY COMPANY, LTD.

Vessel	Captain	Engineer
Miss Vandenberg	A. Black	Frederick Lavery.
	S. Delaney	
Ferdinand	E. P. McGannon	W. J. Jento.

ALGOMA CENTRAL STEAMSHIP LINE.

Vessel	Captain	Engineer
Agawa	M. A. Livingstone	J. L. Smith.
W. C. Franz	W. C. Jordan	A. M. McInnes.
J. Frater Taylor	J. D. Montgomery	W. T. Rennie.
Home Smith	A. McIntyre	D. McLeod.

GREAT LAKES TRANSPORTATION COMPANY, LTD.

Vessel	Captain	Engineer
Glenshee	W. A. Lavigne	P. Goodwin.
Glenisla	J. Tindall	P. Eagles.
Glenorchy	F. Burke	G. Price.
Glenfinnan	W. Taylor	J. Silverthorne.
Glenlyon	A. A. Hudson	D. A. Sinclair.
Glenlivet	M. Stalker	J. A. McChristie.
Glencairn	B. Garvie	J. Gilbert.
Glenstriven	(Unappointed)	E. Hurl.
Glenbrae	R. Burke	R. Knight.
Glencadam	G. Henebery	F. H. Brickenden.

CANADA STEAMSHIP LINES, LTD.

Vessel	Captain	Engineer
W. Grant Morden	C. E. Robinson	Jas. McGregor.
J. H. G. Hagarty	G. W. Pearson	Chas. Robertson.
Emperor	D. W. Burke	Geo. N. Smith.
E. B. Osler	J. H. Hudson	R. R. Foote.
Midland Prince	A. B. McIntyre	J. A. Pickard.
Collingwood	Peter McKay	H. J. Jack.
W. D. Matthews	A. F. McLennan	Wm. Reid.
Midland King	N. McGlennon	Chas. Leriche.
Martian	R. McIntyre	John B. McLaren.
Sarnian	R. Pyette	I. J. Boynton.
Sir Trevor Dawson	H. Hinslea	Geo. Schroder.
Stadacona	G. H. Page	W. L. Shay.
Haddington	R. J. Wilson	A. E. Kennedy.
Toiler	W. H. Montgomery	Emery Scott.
Cadillac	W. Beatty	Hugh Myler.
T. P. Phelan	E. J. Shannon	Thos. H. Hazlett.
Fairfax	H. Heffernan	F. Patterson.
Omaha	K. La Rush	John Holler.
Maplehill	H. A. Leaney	Wm. Keith.
Maplegrove	Herb. Brian	Chas. Gray.
Seguin	W. Brian	F. A. McCauley.
Ionic	Alex. Wilson	A. E. Crosthwaite.
Bickerdike	T. H. Johnson	H. W. Fletcher.
City of Hamilton	O. Patenaude	Wm. Dungan.
City of Ottawa	J. L. Baxter	John Kennedy.
Belleville	J. J. Jarrell	Geo. A. Sauve.
Wyoming	E. Walkinshaw	J. Kirk.

Passenger Steamers, Season 1920.

Vessel	Captain	Engineer
Cayuga	C. J. Smith	W. Taylor.
Chippewa	W. Malcolm	E. A. Prince.
Corona	B. A. Bongard	Joe Kennedy.
Macassa	F. J. Corson	J. A. Gunn.
Modjeska	J. Henderson	No appointment yet.
Toronto	E. A. Booth	J. E. Readman.
Kingston	A. E. Stinson	Geo. MacDonald.
White Star		
Brockville		
Montreal	F. X. LaFrance	Nap. Beaudoin.
Quebec		J. Matte.
Saguenay	J. Simard	Geo. Gagnon, Sr.
Murray Bay	W. Gagne	O. Bonin.
St. Irenee		
Three Rivers		Geo. Gagnon, Jr.
Longueuil	H. Mandeville	N. Noel.
Rapids King	Geo. Batten	Wm. Hazlett.
Rapids Prince	Sam Putnam	Geo. M. Hazlett.
Syracuse		J. A. Belanger.
Rochester		

KEYSTONE TRANSPORTATION COMPANY OF CANADA, LTD.

Vessel	Master	Engineer
Keywest	Capt. A. Barrett	Mr. Alex. Horton.
Keyport	Capt. Geo. Bunting	Mr. Geo. Jarrell.
Keybell	Capt. Leon Beaupre	Mr. R. J. Muchmore.
Keynor	Capt. Wm. Smith	Mr. John M. Robertson.
Keyvive	Capt. John Guy	Mr. Geo. Baker.

MARQUETTE & BESSEMER DOCK & NAVIGATION CO.

Vessel	Captain	Engineer
M. & B. No. 2	John Van Buskirk	J. J. Stevens.

CANADA ATLANTIC TRANSIT CO. OF U.S.

Vessel	Captain	Engineer
Arthur Orr	John Simons	D. E. Mance.
Kearsarge	H. Jaenke	Fred Welke.

ONTARIO CAR FERRY COMPANY, LTD.

Vessel	Captain	Engineer
Ontario, No. 1	S. McCaig	D. L. Smyth.
Ontario, No. 2	F. D. Forrest	J. Alan Nicoll.

DEPARTMENT OF MARINE AND FISHERIES.

Vessel	Captain	Engineer
Grenville	Richard Smith	James Leonard.
Lambton	Alex. Brown	J. M. Brechin.
Concretia	D. Mills	R. Mullins.
Scout	Cory Hart	Geo. Lessard.
Argenteuil	Thos. W. Weir	Alex. Drury.
Dollard	S. Sauvageau	Albert Carpentier.
Vercheres	Adolphe Marchand	H. Robitaille.
Shamrock	A. Toupin	N. Marchand.

CANADIAN TOWING AND WRECKING CO., LTD.

Vessel	Captain	Engineer
Tug Jas. Whalen	A. G. McKay	M. Cosgrove.
Tug Sarnia	Geo. Stitt	L. Williams.
Tug A. F. Bowman	W. Nuttall	
Tug A. B. Conmee	Not appointed	
Barge Empire	W. H. Wilson	
Barge Mary E. McLachlan	Not appointed	
Barge Coteau	Not appointed	

CANADIAN PACIFIC OCEAN SERVICES.

Vessel	Captain	Engineer
Empress of France	E. Cook	Robt. Wilson.
Empress of Britain	Geo. Webster	A. E. Philp.
Empress of Asia	A. J. Hailey	J. Lamb.
Empress of Russia	A. Robinson	W. J. P. Davies
Empress of Japan	W. D. Hopcraft	D. G. R. Smith.
Batsford	W. Henderson	J. Jameson.
Corsican	Alex. Rennie	J. R. Nelson.
Dunbridge	A. Stewart	A Clark.
Grampian	Guy Hamilton	H. G. Donald.
Holbrook	A. H. Sargent	A. Ritchie.
Mattawa	H. Lewis	C. W. Hall.
Melita	H. Parry	R. G. Hughes.
Metagama	Jas. Turnbull	E. McFadyen.
Minnedosa	G. O. Evans	E. H. Stanley.
Montcalm	E. Landy	A. McLellan.
Montezuma	A. H. Clews	W. H. Vine.
Mottisfont	Jas. McDonald	T. Heggie.
Pretorian	J. Hall	J. S. Cumming.
Sardinian	R. McKillop	R. S. Cragg.
Scandinavian	E. Griffiths	J. E. Thearle.
Scotian	W. P. Hains	J. Orme.
Sicilian	H. Latta	W. Stark.
Tunisian	C. W. Hodder	J. Cassidy.
War Beryl	Alex. Ogilvie	B. R. Hood.
War Peridot	J. N. Griffiths	H. Craig.
Victorian	Unappointed	Unappointed.
Methven	H. James	E. T. Painter.
Monteagle	W. H. Froude.	A. J. Hosken

PROGRESS IN NEW EQUIPMENT

There is Here Provided in Compact Form a Monthly Compendium of Shipbuilding and Marine Engineering Auxiliary Product Achievement

THE SIMPLEX SALT DETECTOR

The presence of salt in boilers is now universally admitted to be highly objectionable because of the reduced steaming capacity which results from the deposit of salt on the heating surfaces, and also because of the danger of overheating which is always present when there is scale on these surfaces. In the case of water tube boilers, now being used more extensively than in previous years, where even a small deposit of salt may have serious consequences, greater precautions are generally taken to keep the feed fresh than with the ordinary type of boiler.

The accompanying illustration shows the Simplex Patent Salt Detector which is designed to give a *continuous* indication of any salt in the feed water, and thus show the presence of salt there *before* it enters the boiler; also in the event of a sudden increase of salt—as may occur owing to a split tube, or the evaporator priming—it gives warning immediately, and so allows the defect to be remedied *before* the density of the water in the boiler increases perceptibly.

The presence of salt in the feed water of marine boilers is ordinarily due to leaking condenser tubes and evaporators priming. In the ordinary course, the water in the boiler is tested regularly by the salinometer. These tests are satisfactory so far as they go, but give no indication of the rate at which salt is entering the boiler. It is quite evident that the salinometer test may give the same result when there is a very small leakage of salt water into the feed supply for many hours, as it would give if there was a very large flow of salt water for a short time, as, for example, would occur in the case of a split tube in the condenser.

The apparatus is a very simple one, and its working is based on the well-known fact that pure water has a high electrical resistance, which, however, falls very quickly if certain compounds—of which ordinary salt is one—are added to the water.

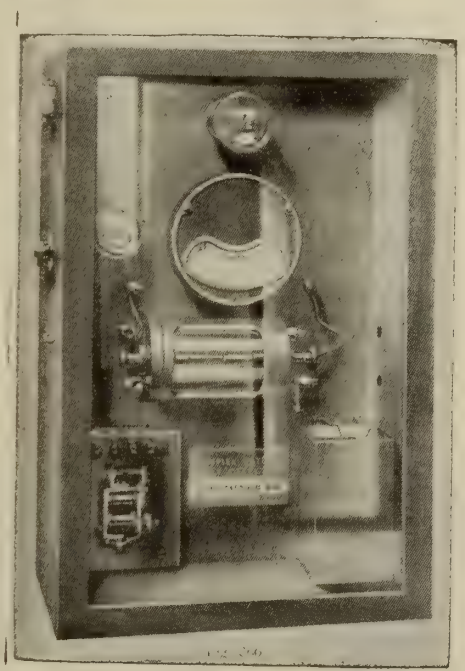
The essential part of the apparatus is a glass vessel fitted with two electrodes by which a current is passed through a sample of the feed water. The necessary current is taken from any convenient power or lighting circuit, either direct or alternating current.

The electrodes are made of a special grade of carbon, and are so arranged that no metal part of the connections is in contact with the water. This is essential to avoid the excessive corrosion which would otherwise take place. The electrodes are adjustable so that the sensitiveness of the instrument can be varied.

As noted above, the instrument gives a continuous indication of the saltness of the feed, and this is done by having a supply of feed water flowing through the vessel—entering at the bottom at one end and flowing out at the top at the opposite end.

The resistance of water falls very rapidly for a small increase in the amount of salt present and this tends to make the simplest arrangement too sensitive. To obviate this, in the Simplex apparatus, a resistance is introduced which is preferably in the form of an incandescent lamp. By varying this resistance, or in other words by using lamps of different candle power, the sensitiveness can be varied as desired. A high candle power lamp gives greater sensitiveness, and a low candle power less sensitiveness.

The voltage of the lamp should be slightly lower than the line voltage—about 5 to 10 per cent. is a good average value. The lamp shows no light when the water is fresh, but as soon as salt is present will begin to glow a dull red, which gradually increases to full brightness as the salt increases. The brightness of the lamp enables the officer on watch to see at a glance whether there is salt in the feed, and also whether it is in sufficient quantity to require immediate attention.



SIMPLEX SALT DETECTOR.

The voltmeter gives a quantitative indication of the amount of salt present, and may be calibrated, if desired. This cannot be done, as a rule, with any great accuracy, however, in the majority of cases, as the readings vary considerably with the temperature of the feed water.

In many cases it is desirable to have a definite warning given immediately the salt exceeds a fixed percentage. This is given by a bell or buzzer, which is arranged to be operated by a relay connected in series with the instrument. The relay is very easily adjusted so as to operate at the desired density.

As will be seen from the illustration, the whole apparatus is self-contained in a polished teak case, with plate-glass door. The buzzer is fitted to the outside of the case, while the connection to the electric circuit is made by a plug, so that it is only necessary to insert the plug in the socket and take a connection from any lamp holder.

While the arrangement shown is the usual one, it can be varied as desired. The various indicators—voltmeter, lamp, and buzzer—can equally well be fitted in any other position, and at any distance from the instrument.

It might be preferred, for instance, to have the voltmeter, or one of them, on the control platform, with the buzzer in some other position; this is very simply arranged. In a large power station a Klaxon horn is a most effective warning.

Should a log be required showing the condition of the feed throughout a watch, or any other period, this can be arranged by having a recording voltmeter with a roll or circular chart operated by clockwork in the usual way.

The sensitiveness of the instrument is very great, and compares well with the nitrate of silver test. One grain of salt per gallon can readily be shown. If is thus very suitable for use in connection with the distilling of fresh water for drinking purposes.

While the apparatus was intended, in the first instance, for use in marine work, there are many other applications in connection with chemical works, etc., which will readily occur to those familiar with them.

The Simplex Detector has been in constant use for several years in some of the largest power plants, steamship companies, and industrial works, and has given unqualified satisfaction in every case.

The machine is sold by the McNab Co, of Bridgeport, Conn., U.S.A., who have several lines of marine specialties.

THE WEBSTER CO. INDICATOR

The W. R. Continuous CO_2 Indicator (a war-time invention) is specially suited for marine boilers. By its use, it is now possible to run marine boilers with the same rigid regard for fuel economy as is practised by the large electric power stations. This Indicator is automatic, fool proof, requires no skill, supervision or attention, and will last as long as the boiler itself. When it requires cleaning, all that is necessary is to swill it out with a bucket of water, or play a hose pipe on it.

It is essentially a fireman's instrument, and it is found in practice that the fireman watches it as he does his steam gauge. If he has a thin fire or one with a hole in it, which allows air to pass through the fire unconsumed, the Indicator notifies him of it, and so enables him to maintain an efficient fire all the time, and by saving coal he soon discovers that he reduces his own labor, as the more coal he saves, the less he has to shovel on the fire.

As already stated, the saving in fuel is effected by burning a high percentage of air. The burnt air passes up the flue in the form of $C O_2$. All the experts are agreed that the criterion of good combustion is a high per-

centage of carbon dioxide (CO_2) in the flue gases. The more air one burns, the more CO_2 is found in the flue gases, hence the presence of a high percentage of CO_2 in the flue gases proves that air is being burned in the furnace. The W. R. Indicator promptly, continuously, and automatically analyzes the flue gases and indicates the percentage of CO_2 on a large size water column in a gauge glass tube, which can be read at a distance of 20 yards. The Indicator is so positioned in the fire room that the fireman can read it easily while working, just as he reads the steam gauge.

If the proportion of air and fuel is absolutely perfect the instrument will show about 19 per cent. of CO_2 to be passing up the flue. The average CO_2 shown when the instrument is first fitted is usually very low—about 5 per cent. Where only 5 per cent. of CO_2 passes up the flue, 50 per cent. of the coal consumed is wasted. Where the average of CO_2 passing up the flue is increased to 14 per cent., only 20 per cent. of the coal consumed is wasted. Thus the difference means a big saving of coal.

The relation of coal consumption to the CO_2 in the flue gases has been worked out, and the results are given in the standard treatises on fuel. These results are as follows:—

Per cent. CO_2..	5	7	9	11	13	14	Flue gas temperature 600° F
Fuel wasted....	50%	35%	27%	23%	21%	20%	

Thus it will be seen that to increase the CO_2 in the flue gases from 7 to 14 per cent. effects a 15 per cent. saving in fuel.

The W. R. Indicator is the most accurate CO_2 Indicator on the market. A large firm of boiler makers, after long tests, reported that the deviation from absolute accuracy was 0.1 per cent. The engineer of a large paper works where an instrument has been installed for many months reports that the greatest deviation from absolute accuracy he has found has been 0.3 per cent. Of course so minute a deviation as this is absolutely negligible. It is also the most prompt in its action, having a lag of 1 minute only as against 30 minutes with most CO_2 recorders.

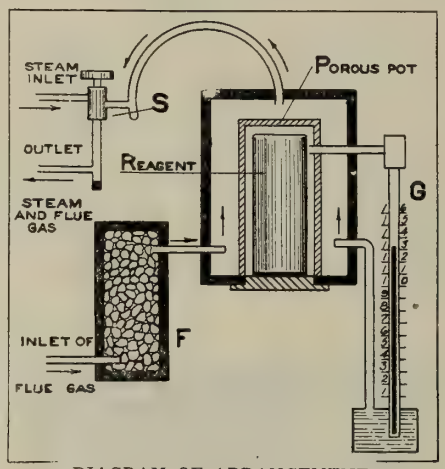


DIAGRAM OF ARRANGEMENT.

The only attention the W. R. Indicator requires is, occasionally (say once a month) to swill the instrument out with a bucket of water and to renew every other day an absorbent cartridge supplied by the Company, an operation which takes one minute to effect. The saving in coal this little attention enables one to effect is very considerable.

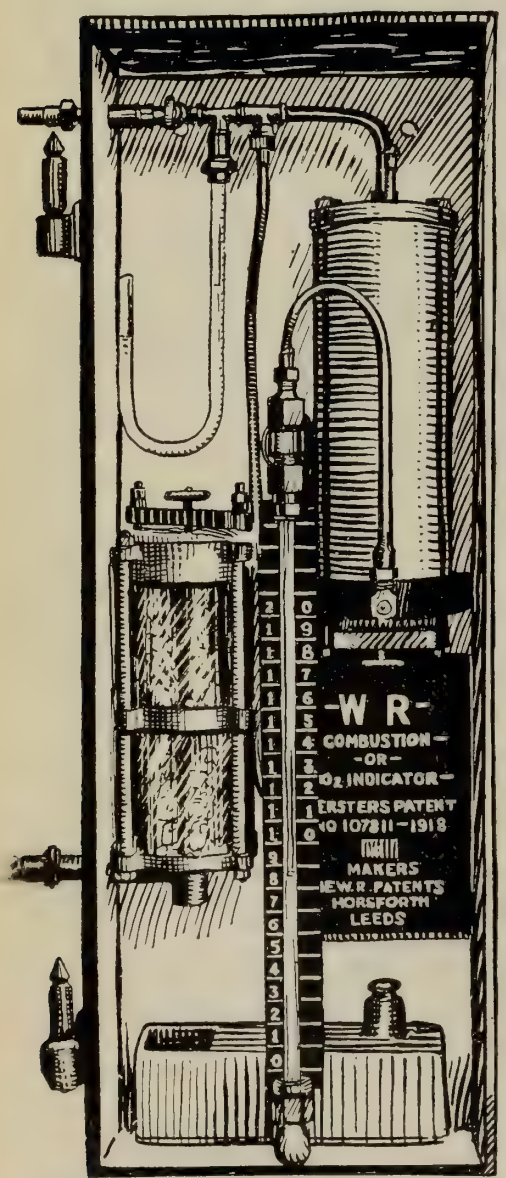
The following describes the action of the Indicator:

An aspirator worked by a minute jet of steam continuously aspirates gases from the flue which it is desired to keep under observation. The path of the gases is shown by arrows. They are first drawn through a filter, and pass from thence into a chamber containing a porous pot inside which is a dry reagent (see Fig. . .). A pipe connects the chamber with a vessel containing water into which dips one end of another pipe *G*, the other end of which is taken into the inside of the porous pot. Some of the gases penetrate into the interior of this pot, and are absorbed by the reagent, with the result that a partial vacuum is formed, and the water is forced up the pipe *G*. The latter is provided with a scale so graduated that the percentage of CO_2 in the flue gases can be read. In those cases where forced or induced draught is in use the steam injector can be dispensed with. The amount of steam taken by the injector is very small—not more than one pint of water per hour.

Figs. . . and . . show, respectively, the small and standard types of W. R. Continuous CO_2 Indicators, quotations on which will be furnished upon request.

The W. R. Indicator is suitable for all types of marine boilers, whether the fuel used be coal or oil. It can be fitted to a boiler in about four hours.

The ease with which the apparatus can be installed without disturbing or re-arranging existing equipment will be made apparent by an inspection of these diagrams.



WEBSTER INDICATOR, STANDARD SIZE.

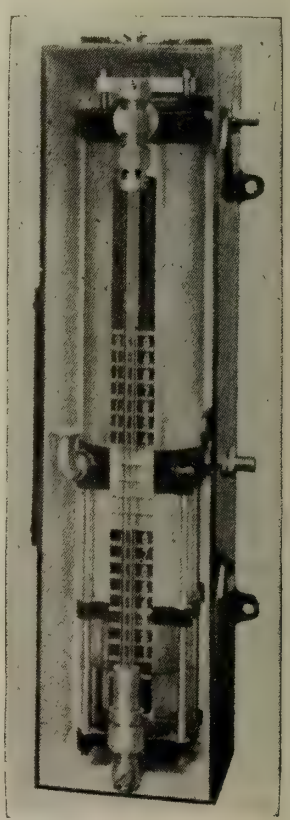
MILLER ATTACHMENTS

The Ryerson-Conradson Co. have, in conjunction with their helical drive miller, placed on the market a dividing head and vertical milling attachment.

The vertical attachment is shown at Fig. 1, and as can be noted, this attachment is of the semi-universal type.

The fixture fits both their plain and universal machines, and is made in light, medium, and heavy patterns.

The base is clamped to the column dovetail, no dependence being placed on the overarm. The heavy pattern type has the same diameter spindle and the same size bronze bearings as the main spindle. The taper hole face plate and driving keys also are the same, permitting as heavy a cut to be taken as on the horizontal spindle.


WEBSTER INDICATOR, SMALL SIZE.

The drive is effected by a large aluminum bronze gear bolted to the face plate of the main spindle and driven by the cross key. In return, it engages a steel gear on a horizontal shaft, driving the vertical spindle through a set of bevel gears. This allows the spindle to be set at any angle parallel to the face of column. A draw-in bolt is furnished.

The dividing head as shown has been designed to meet the exacting requirements of modern shop practice. It is especially rigid and provided with an extra large worm wheel, meshing with a worm journaled in large bearings. The worm and worm shaft are of one piece, made of high-grade steel, heat treated and then ground to secure extreme accuracy. Means are provided for quickly disengaging the worm from spindle and to take up all backlash that may arise in the course of time. The spindle and face plate are forged in one piece from high carbon steel. This design provides an exceptionally rigid arrangement for mounting chucks and fixtures on the face plate. The hole through the spindle is very large, 3 1-16 in. in diameter, and a No. 14 B. & S. taper is used. The face plate is 8 in. in diameter, has 24 holes for direct indexing and a ⅝ in. x 7-32 in. slot for holding the driving dog. The centres will swing 14¼ in. in diameter. The head is graduated and can be securely clamped in any position from 10 degrees below horizontal to 10 degrees beyond the perpendicular. The entire dividing head shows careful designing, especially in the absence of delicate details.

The regular equipment consists of three index plates that divide all numbers to 50 and many beyond; wrenches, bolts, driving dog and index table giving all divisions up to 360.

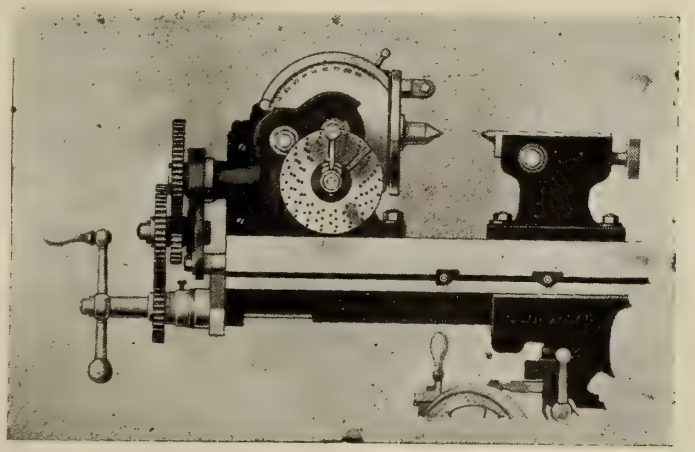


FIG. 2—GENERAL APPEARANCE OF UNIVERSAL DIVIDING HEAD.

U. S. ARMY TRANSPORT SERVICE TESTS NEW LINE-THROWING GUN

The U. S. Transport Service has just completed an exhaustive test of a new line-throwing gun which shows many big advantages over the line-throwing guns now in use.

This test is one phase of the Government's endeavor to urge by example that all shipowners take every voluntary precaution possible to insure the saiety of ships, and the lives and cargoes they carry.

Under the auspices of the U. S. Army Transport Service the test was conducted at No Man's Land, Fort Hamilton, N.J., and was superintended by Captain W. J. Barnard, Chief of Army Transport Service, Hoboken, N.J. He was assisted by Capt. Robert Bartlett, of Peary Polar Expedition fame, and Capt. J. S. Allen, both of whom are attached to the same Service and stationed at Hoboken, N.J.

Ex-Senator Long and many prominent representatives of the mercantile marine were also in attendance. The Ordnance facilities of Fort Hamilton were accorded by Capt. R. J. Imperatori, U. S. Coast Defence Ordnance Officer, who with other Ordnance experts co-operated in conducting the test.

A long stretch of beach within the precincts of Fort Hamilton was used for the testing grounds. Close watch was kept to note the time necessary to make complete preparations for firing, as speed in doing this is one of the claims made for the new gun. It was found that there were only one and a half minutes between the gun reaching the desired spot and the pulling of the lanyard. This is due to the patented features eliminating charging and priming. The new gun

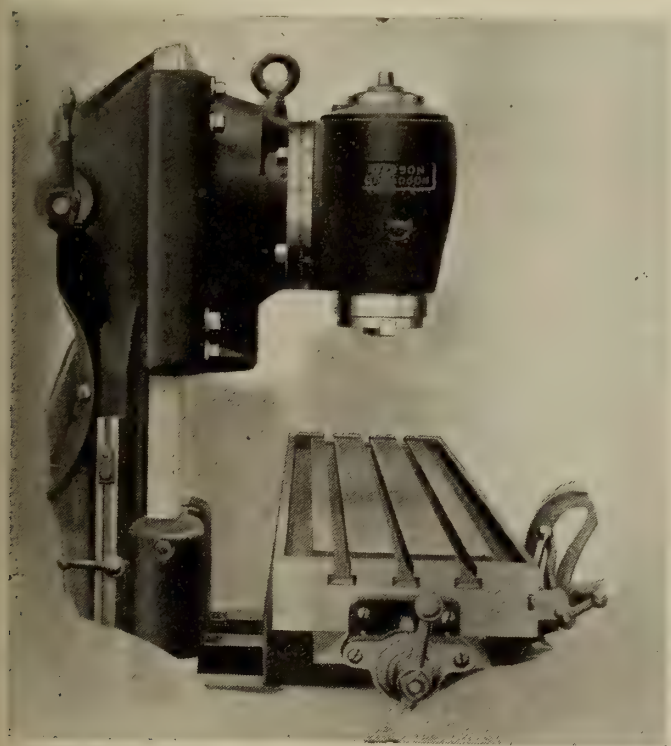
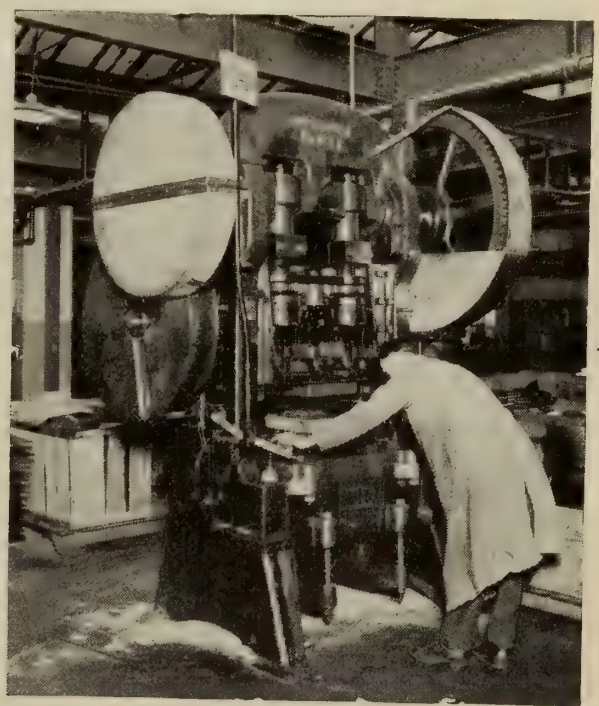


FIG. 1—VIEW OF VERTICAL ATTACHMENT.



GENERAL VIEW OF THE SAFETY DEVICE.

having its powder charge in a water-proof cartridge which is attached to the projectile, permitting complete loading in a single operation.

An imaginary ship at a distance of 1,400 feet was pointed out to the gunner. With the barrel at an angle of 30 degrees, the line crossed the vessel squarely amidships and passed well over. The total linear distance covered by the line was found to be considerably more than 1,400 feet required by the U. S. Steamship Inspection Board. Shots were fired with the muzzle at every conceivable angle that a gun would be expected to fire to have the line cross the deck of a ship in distress. This is made possible by the new gun having a changeable elevation from 30 to 80 degrees. In all the shots fired, not one was less than 100 per cent. successful.

During tests of this nature the Government specifies that the durability of the guns shall be tested by having the projectile fired from the gun without the line being attached. In this way any flaws in the gun's mechanism will be shown up. The new gun passed this test with ease. It fired the shot from a 45-degree angle and used a 9¼ ounce powder charge. After examining the gun following this shot, Capt. Imperatori said the gun's mechanism was not affected in the least.

At the close of the test Capt. Barnard gave a verdict of entire satisfaction for the new gun's safety, simplicity and efficiency, and assured the inventor's representative, that the gun will be adopted by the U. S. Transport Service with as little delay as possible.

This new gun is manufactured by the General Ordnance Company, and is named the G-O Line-Throwing Gun. This same company also invented and manufactured the famous Y gun used by the U. S. Navy for anti-submarine warfare, also a special three-inch gun which was the only heavy, anti-submarine gun used on air-craft by the U. S. Navy during the war.

NEW MACHINE TOOLS FOR CANADIAN MARKET

It will be interesting to the Canadian machine tool trade in general to know that the Albert Herbert, Ltd., of Coventry, England, have opened up a Toronto office. Their present headquarters are at 31 Yonge Street, but this is by no means their permanent abode. They have merely opened up this office until they complete arrangements regarding proper warehouse premises.

It is their intention to carry in stock a representative line of machines made by the Albert Herbert, Ltd., also other various companies that they represent. They already have a number of machines en route for Canada, and it is their intention to have their stock assume considerable proportions in the near future.

One big point in their favor is the fact that the staff will consist of both practical and technical men who are thoroughly versed in modern machine tool practice, and intimately acquainted with the machines they will handle.

This allows them to be in a position to furnish the trade with all necessary technical information, and give full service in as far as service and the obtaining of maximum production is concerned. In addition to their own lines, they will handle other tools which are new to the Canadian market, a list of which follows:

The Webster & Bennet, Coventry, line of boring mills and automobile profilers.

The G. Stirk & Sons, Halifax, line of planers and boring mills.

The H. W. Kearns Co., Manchester, Horx boring, milling and facing machines.

The Lumsden Machine Co., Ltd., Gateshead-on-Tyne, line of grinding machines.

Power and hand presses made by J. Rhodes & Sons, Wakefield.

The L. Gardner & Son, Pancroft, Manchester, line of crankpin turning machines.

The Tangyes Limited, Birmingham, line of heavy machine tools.

The Britannia Foundry Co., Coventry, line of foundry appliances.

The Manlove Alliot & Co., Ltd., Nottingham, line of oil separators.

The W. D. McKendrick & Co., Motherwell, line of girder radial drilling machines.

The B. Smith & Sons, Todmorden, line of chain mortising machines.

The Moses Eadon & Son, Ltd., Sheffield, line of high speed and carbon steels, saws, machine knives.

The Scriven & Company, Leeds, line of shipyard and rolling mill equipment.

The Vulcan Foundry Co., Ltd., Newton-le-Willows, line of Vulcan pneumatic riveter for locomotive work.

The George Taylor & Sons, Coventry, line of small vertical milling machines.

The H. Wallwork & Co., Ltd., Manchester, line of gear generating and hobbing machines.

The E. C. Wrigley & Co., Ltd., Birmingham, line of twist drills, reamers, milling cutters.

The E. G. Herbert & Co., Manchester, line of hack sawing machines and small tools.

The H. Atkins, Ltd., Peterboro, line of light machine tools.

The Herbert Eng. Company, Reading, line of floating tool holders.

J. Buckton & Co., Ltd., Leeds, line of heavy machine tools.

This varied line illustrates on what a scale the Herbert Co., Ltd., have entered the machine tool market. Many of these lines have special points of interest which will be presented to readers in the near future. Anyone interested can be assured of courteous treatment and careful attention at the hands of Mr. Blair, who is the representative of this company.

A new French tool steel, known as Etiquette Rouge is according to L'Importateur Francais, a cast steel containing tungsten and suitable for the manufacture of screw taps and dies. It can easily be tempered and resists corrosion, it is claimed, to a remarkable degree. After being carefully and completely heated to a bright red at a temperature of from 760 deg. to 780 deg. C, it is dipped in water at about 15 deg. C. Small sections can be dipped at a lower temperature. A second grade of tool steel, K9, used in making precision tools, is also described. This steel, it is said, is practically free from expansion and contraction during tempering. Its treatment requires gentle and complete heating at from 780 deg. to 880 deg. C., and the use of an oil bath. The two steels are delivered annealed and ready to be worked.

A substitute for cork can be made, according to the "Berlingske Tidende" by the action of acetylene on the oxides of copper and nickel.

BOOK REVIEW

We have received a copy of a very useful book on "Mensuration for Marine and Mechanical Engineers," by John W. Angles, M. Sc. (Eng.), who is head of the Engineering Department, West Hartlepool Technical College, England. The publishers are Longmans, Green & Co., of London and New York. For marine engineers going up for their examination the book should be a boon, as it contains within a small compass practically all the information on geometry, mensuration, trigonometry, and logarithms, that are required for a first-class B. O. T. certificate. There are one or more completely worked examples of every proposition, and these examples are all relating to practical, everyday problems of the marine engineer's profession. In the appendix the areas and volumes of circular figures and cones are determined from first principles by means of the calculus, and there is a very good chapter showing the use of Simpson's rules. The book is sold at $1.75, and is a very useful book for any engineer to have by him.

The Superior Collet Chuck Company of Grand Rapids, Mich., are now making a new type of collet chuck for drilling machines.

The Morse Chain Company, Ithaca, N.Y., announce that they have moved their South-eastern States office from Greensboro, N.C., to Charlotte, N.C. This has been necessitated by the great growth of the textile industry, who are large users of the Morse Company's product.

Some experiments are in progress, according to the "Aerial Age," on the effects in the process of brazing steel on long immersion—that is to say, from three minutes to one hour—in the bath of molten spelter. So far no deleterious effects have been noted. The steel gradually goes into solution at the rate of about 0.001 in. on each surface every two minutes. It has been found that the presence of dissolved iron increases the strength of the spelter. Experiments are being continued with traces of manganese in the spelter, and it is thought posible to obtain an ultimate strength of between 100,000 and 200,000 lb. per square inch for the brazed parts.

NEW THINGS IN MACHINE TOOLS

The Grand Rapids Machine Company are now manufacturing a line of tap-grinding machine for grinding the taper and the clearance on the ends of taps.

The Badger Tool Company of Beloit, Wis., are now making a new line of grinding machine, known as the No. 4. The spindle is fitted with both radial and thrust ball-bearings.

A new compression coupling, for use on shafts between 15-16 and 3 inches in diameter, has been placed on the market by the Cincinnati Ball Crank Company of Cincinnati, Ohio.

The Streine Tool and Manufacturing Company of New Bremen, Ohio, have recently brought out a new toggle forming press for roofing and special shapes, with a capacity up to 12 feet in length. It is also provided with tables for die work.

An interesting spiral fluted taper reamer, that may be used in drilling machines, is now being made by the Gammons-Holman Company of Manchester, Conn. They work rapid and cut freely, the chips resembling fine wool. These reamers are made in all the standard sizes.

The Lapoint Machine Tool Company of Hudson, Mass., have added a new type of broaching machine to their regular lines, which will be known as the No. 3 Duplex. The power screws may be operated jointly or as separate units as desired, and to any required length of broach.

The latest improvement in the 8-inch Hercules gear-hobbing machine, made by the Hercules Machine and Tool Company, of Astoria, N.Y., provides for exhaust adjustment in the centering of the hob. Automatic stops are provided for disengaging the feeds when machining the various classes of gears.

A special design of portable grinding machine, manufactured by the Mummert-Dixon Company of Hanover, Pa., has some very interesting features. The machine is self-contained and the wheel may be operated at any desired angle without interfering with the feneral alignment. Ball-bearing parts assure easy movement.

What has been turned a short-cut lathe has been placed on the market by the O. R. Adams Manufacturing Company of Rochester, N.Y. The headstock is designed to give six changes of speed, with a range from 43 to 375 r.p.m. Speed changes can be made while the lathe is in operation. The spindle is prevented from turning when in a neutral position by the action of a brake.

A two-motor, high-power radial drilling machine, of the Ryerson-Conradson type, is the latest product of the Jos. T. Ryerson and Son Company of Chicago, Ill. These drilling machines are made in sizes of 4, 5, and 6 feet arms. The principal feature in the design is the small number of shafts and gears used, there being only four shafts and sixteen gears in the machine. S. K. F. ball bearings are fitted in the head. The spindle drive is obtained from a vertical reversible motor, direct connected to the drive shaft by a self-aligning coupling. An independent vertical motor is used for raising and lowering the arm.

The Victor Tool Company, of Waynesboro, Pa., has recently placed on the market a new collapsible taper-cutting pipe tap. Some interesting details are incorporated in the design of these tools. Sizes range from 2 to 12 inches.

The Bicknell-Thomas Company, of Greenfield, Mass., has added to its line a vertical tapping machine for bench use, with a capacity from 0 to 3-16 in. taps. A special work fixture may be used in place of the ordinary table. The machine stands 15 inches high and weighs about 48 pounds complete.

The Atlas Press Company of Kalamazoo, Mich., are placing two new arbor presses on the market, one of 6 ton and the other of 15 ton capacity. They are adapted for a variety of work, such as forcing arbors in and out of work to be turned, for straightening and broaching operations, in assembling parts where force fits are required, and for other similar purposes.

A special line of air-operated chucks for service on Jones and Lamson double-spindle turret lathes has been developed by the Frank G. Payson Co., of Chicago, Ill. The body of the chuck is made in one piece and requires no adapter for its attachment to the spindle. The air chuck is located at the rear of the spindle and is connected to the chuck by a rod running through the hollow spindle.

A special tool for use in drilling machines, for the counterboring of holes, facing, forming and similar operations, has been placed on the market by the Genesee Manufacturing Company of Rochester, N.Y. These tools are made in two styles, with two and three cutters, and each style is made in four sizes, ranging from 1¼ to 3 inches outside diameter.

The Detroit Hexagon Drill Company of Detroit, Mich., are now making a line of special tools for the cutting of square and hexagon-shaped holes. These tools may be used either in the drill press, where the drill revolves, or in other machines where the drill is fixed and the work revolves. Tools of this type have been successfully used on steel, iron, brass, aluminum, micarta, bakelite, wood, marble, etc.

The Dauber-Kratsch Company, Oshkosh, Wis., has added a new type of drilling machine to their Wisconsin line. The all-geared mechanism is similar to their gear-driven 20 inch machine, which at present is being made up as two, three and four-spindle drills. The new design has a base of unit construction, so that machines of two or more spindles can be built up as desired and added to as occasion requires.

The Simmons Machine Company, of Albany, N.Y., are now manufacturing an open-side planer that will take care of work 42 inches wide, 48 inches high and up to 12 feet in length. The table is of the double-deck type and has three T-slots, the centre one running the entire length of the table. The column is of box pattern and amply reinforced with inside ribs. The L-shaped cross rail is designed to resist the severest strains and has a long bearing on the column.

The Toledo Milling Machine Company has placed on the market a new type of vertical milling machine. The unit method of construction has been adopted so that the table, saddle or the knee may be quickly taken off and replaced and the feed-gear case may be taken off with the gears intact by the removal of six screws. A feature of the machine is the control of the different movements, which is carried out from the one operating position, and, by means of an engaging lever, the control of the table movements, lateral, cross or vertical, can be transferred to the centrally-located handwheel on the knee. Automatic disengagement of the feeds are provided. The spindle has eight changes of speed, ranging from 97 to 411 r.p.m. with open drive, and eight with the back gears, ranging from 18 to 76 r.p.m. Longitudinal movement of the table is 46 inches and the traverse 14 inches, and a vertical movement equal to the traverse. The spindle has a vertical movement of 6½ inches. The table surface is 56 by 14 inches. Total weight of the machine is approximately 7,000 pounds.

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Resuming an Old Fashion

THOSE who are wont to bemoan the departure of all that is beautiful from the world, with the advent of highly specialized industry, may take fresh hope. In the marine world, where progress follows progress in bewildering fashion, there has suddenly arisen a champion of what at first sight would seem reaction. This gentleman claims that future ships should be built with a receding stem, instead of the straight stem so much in use now.

Those lovers of beauty who used to pause to admire the exquisitely curved stem, finished off, as it usually was, with a more or less artistic figurehead, will claim the defender of the curved stem as one of themselves. It is not in the interests of beauty, though, that the receding stem is being advocated, but in the interests of safety. Both life and property will be much more secure if, in the event of collision, the striking vessel possesses a receding stem instead of a straight one. As most dangerous collisions are end-on ones, where the colliding ship usually strikes the victim on the broadside, the effect of the straight stem is to do as much damage below the water line as above it, the blow taking place along the full height of the stem. With the curved or receding stem, the blow takes effect at first high up on the ship's side, and before the damage can extend downwards the stem has to force its way through decks and frames. The force of the blow is thus absorbed much before the damage can reach a point on the water line or below it, and instead of the collision resulting in the sinking of the ship in a few minutes, there is very little chance of the vessel sinking at all.

There is at least one firm of shipowners who are building their stems on these lines, notwithstanding the fact that by so doing they have to pay larger dockage rates, owing to the extra space occupied by the overhanging stem. The safety feature of this type of construction so much appeals to them that they cheerfully stand the added expense. It is the desire of a good many people, that this form of stem be made compulsory, and a much greater degree of safety attained thereby.

The New Steel Merger

THE project outlined by Col. Grant Morden in his speech before the Empire Parliamentary Association at Ottawa is one to stir the imagination. It is a great step towards the realization of that beneficial Imperialism of which Cecil Rhodes was such a great exponent. Ore from Canadian mines, smelted by coke obtained from Canadian coal, and turned into billets by Canadian labor. The billets and blooms in turn shipped to the great steel manufacturers in Great Britain, and thence distributed to all the countries of the Empire in the form of productive machinery. Here, too, is the greatest hope the shipbuilding industry in Canada has yet seen for the future. A company of the magnitude of the one projected will bring down the cost of raw material to the shipbuilder. It will require for its own business a good sized fleet, which conceivably would be built nowhere else than in Canada. By making available cheaper plates and shapes it will put the Canadian shipbuilder, and especially those on the Atlantic coast, in a position that will enable them to compete on equal turns with anyone. The merger will be a great thing for Canada, a help to the Mother Country in her struggle to retain her lead in world commerce, and a benefit to every portion of the Empire.

Those countries, like Australia and South Africa, which are just at the threshold of industrial development, will reap the benefit of cheaper machinery.

The thing most needed to get the increased production which everyone cries for is just such a combination as this. Sane unions of capital with resources, and as little assistance or interference as possible from Governments, will put the world on its financial feet again with the least possible trouble to everyone concerned.

Report of Conference Held in Toronto

At a conference of Shipowners and Executive Officers of the Canadian Merchant Service Guild held in Toronto, the Shipowners were informed that at the end of this year the members of the C.M.S.G. intended to place before them a classification of our vessels suitable to members of the organization, together with a minimum scale of remuneration for each grade, this your employers agreed to consider when presented.

Your employers informed your representatives that the Canadian Shipping Act is undergoing a process of reconstruction and any recommendations you might consider necessary along those lines should be presented to your Government, with all the force of your organization to back it up at the earliest possible moment.

Your employers were informed by your representatives that although they did not intend to ask for an increase in salaries at the present time as it might very materially interfere with any arrangements they may have already made for the present year, yet a great majority of our members considered that the increase in their salaries had not been in proportion to the increase made to other members of the crew and if any adjustment could be made along those lines, members of the Guild would very much appreciate that effort on the part of their employers, but for the time being this matter would be left entirely in their hands for consideration.

Many other matters of very great importance to our navigation came up for discussion and those present were extremely gratified to see the harmony and good will expressed by all speakers together with the readiness of your employers to come half way to meet any suggestions made for the betterment of working conditions in our profession.

It seemed to be the unanimous feeling of those present that one such conference should be held each year at the end of navigation and also, if found necessary just before the opening, as such could not fail to become of great value educationally, as well as otherwise, to those carrying on our Merchant Service, and at conferences of this kind members of the Canadian Merchant Service Guild would be entitled to place whatever grievances they may have, with a view to the betterment of our profession either individually or through their representatives without fear or favor, knowing that every possible effort would be made to find a remedy so that these grievances should be eliminated from our profession in future as it was fully conceded that such a procedure would go a very long way toward creating a higher standard of efficiency in the profession which meant so much not only to those directly interested, but also to Canada as a whole.

The Secretary of the Grand Lodge would be very pleased to hear from your district with regard to the subjects herein mentioned, more especially that of the classification of our vessels and amendments to the Shipping Act, also your views regarding the boundaries of your district.

ANNUAL MEETING OF THE C.M.S.G.

The executive members of the above named organization went into session at 2 p.m. on the date mentioned, with Capt. R. D. Simpson as chairman, and on taking the chair, he gave a very suitable address and hoped the members present would give him all the assistance possible to carry on the business of the session.

The Secretary now being asked for report on rising, thanked the members present for their attendance and informed them that the finances of the Institution, after paying expenses for the year had increased from $567. to the neighborhood of $1,000, and that a report would be issued after the auditors had finished their work.

Moved, seconded and carried: That the Secretary make the necessary arrangements to amalgamate with the Guild in British Columbia, and also Halifax, so that at the earliest possible moment the organization may be operated in theree sections, namely, East, Centre and West.

Moved, seconded and carried: That in future the fiscal year should end January 1st, each year and all dues should become payable on that date.

Moved, seconded and carried: That all associate members should be eliminated from the organization.

5 p.m.—Moved, seconded and carried: That the session take recess until 10 a.m. next day.

At 10 a.m. on resuming business it was moved, seconded and carried: That only Certified Officers including second Mates and Wheelsmen should be admitted to membership.

Moved, seconded and carried that each member's dues should consist of $10 per year including Legal Defence and a button to be worn by each member as an emblem of goodwill to his organization.

Moved, seconded and carried: That each of the 12 districts should as soon as possible provide themselves with a President and Secretary so that the work of the organization might be carried on by the members residing in each district, and that 50 per cent. of each member's fee should be paid as capita tax, to the Grand Secretary as a general fund, to carry on the work of the Grand Lodge, the remainder to remain in each district to defray any necessary expenses.

Moved, seconded and carried: That five months grace be given each member to pay his dues and thereafter he would be considered out of benefit until all arrears had been paid up to date.

Moved, seconded and carried: That Capt. R. D. Simpson become First Grand President of the organization in this section, and on taking his place he was very heartily

received and congratulated by those present.

Moved, seconded and carried: That Capt. A. McIntyre become Vice-President, and on taking the vice-president's chair he was verily heartily received and congratulated by those present, and on rising to respond he expressed himself very forcefully in favor of the aims and objects of the organization, thanking those present for the honor they had conferred on him.

Moved, seconded and carried: That W. Inkster fill the position of Grand Secretary.

The business of the session now being over, moved, seconded and carried: That the session close until the next call from their Grand Secretary.

REPORT OF ENQUIRY INTO THE LOSS OF S. S. BOHEMIAN

IN the matter of a formal investigation into stranding of the British S. S. "Bohemian" on Broad Breaker, Sambro Ledges, Nova Scotia, at about 2.50 a.m. on March 1st, 1920, resulting in the loss of six lives, held in the Customs House, Halifax, N.S., on March 5th and 6th, 1920, before Captain J. Blanchard Henry, Commissioner, assisted by Captain Neil Hall and Captain C. O. Allan, acting as Nautical Assessors.

Mr. W. A. Henry, K.C., appeared on behalf of the Owners and Master.

The S. S. "Bohemian" a steamer of 5,544 tons net, 8,855 tons gross, Official No. 113,400, registered in Liverpool, owned by the Leyland Line, is 534 feet in length, 58 feet beam, was drawing 24 feet 7 inches forward, 25 feet 8 inches aft, with single screw triple expansion engines, has three compasses, the standard, which was adjusted about two months ago, having an error of but two degrees. All the desk officers held master's certificates.

She left Boston on February 28th, with 65 passengers, 115 of a crew, bound for Liverpool, via Halifax. At 5.10 p.m. on February 29th Brazil Rock was passed a mile distant on a course N. 55 E true. At 8 o'clock Little Hope Island was 6½ miles off by four points bearing.

The ship continued on the same course until 1.30 a.m., March 1st, when the master was called in accordance with his instructions as left in the night order book, and at 1.58 the Direction Finding Station at Chebucto Head was asked for radio bearing, which was given at 2.05 a.m. as Chebucto Head approximate bearing from 207 degrees east of true north.

After consulting the chart the master considered the radio bearing was incorrect, and without verifying his position by soundings, continued on his dead reckoning, as he considered he had a visibility of 5 to 6 miles.

At. 2 a.m.the telegraph was put at standby and at 2.20 the speed was reduced to slow,—approximately 4 to 5 knots—the master intending to continue on for 2 or 3 miles before hauling up for pilot station; but at 2.40 a.m., the course was altered to N 10 E. true, without any soundings being taken, or the ship's position otherwise verified, and as the course was being altered Sambro Light was sighted at a presumed distance of 5 or 6 miles, the explosive signal at Sambro being heard about the same time, followed a little later by the sound of Chebucto Fog Horn.

Still no soundings were taken, even though the Sambro Light Vessel was not sighted—as it might be expected to have been from a vessel in the position the "Bohemian" was presumed by her master to be with the assumed visibility.

At 2.50 a.m. March 1st the vessel struck on Broad Breaker, and, though efforts were made by engine movements to float her, they were unsuccessful and the vessel finally broke in two about 3 a.m. on March 2nd.

Vessels arrived from Halifax in response to wireless calls, and all passengers were safely landed on the morning the ship stranded.

During the day of March 1st some of the crew were engaged in work for the Salvage Company; but this work was completed the same evening.

The unanimous opinion of the master, Surveyor and Salvage experts was that the ship was quite safe for two or three days; but, unexpected circumstances developed and the ship broke in two about 3 a.m. on the second, without loss of life or personal injury—although there were about 100 men on board, including master, officers, crew, surveyors and salvage men—and shortly after the transfer of these remaining on the ship was started by means of rope ladders and lines from the "Bohemian" to the tug "Roebling" which was alongside.

During the transfer from ship to tug in the early hours of a very cold morning six lives were lost, the victims apparently not being able to maintain their holds on the ice-coated lines as a result of their hands being frost bitten, or through the burning of the palms of their hands in sliding down the rope.

It is worthy of note that those lost included five from the steward's department and one fireman, who might have been more affected through the cold weather than the deck staff.

As later events proved it would have been possible for all to remain on the after part of the ship until well after daylight, in fact until 10 a.m.

Finding

After careful consideration of the evidence the Court finds that the S. S. "Bohemian" was well found and equipped and was properly navigated from Boston until approaching Sambro when the master was called at 1.30 a.m. on March 1st.

Without taking the necessary steps to obtain an accurate estimate of the distance off Sambro Light—which is surrounded with such dangerous outlying ledges—the master either thoughtlessly, or though some unexplained reason, (except over-confidence as expressed by the master; but which the Court cannot accept) continued to haul ship on her northerly course, and into danger, without availing himself of the good soundings, or taking a bearing abaft the beam, which would have immediately given him the information so vital to the occasion, with the result that the ship struck at about 2.50 a.m. on the Broad Ledge, one mile east of Sambro Light, which goes to prove that the ship was much closer than the Captain or Second Officer estimated.

The master had also plenty of time to have had another bearing from the Chebucto Direction Finding Station before assuming his northerly course; but did not do so.

The Court is cognizant of the difficulties experienced by navigators during the war, through mine and submarine zones, and other enemy dangers, and cannot but consider the excellent war record of Captain Hiscoe, who, from the evidence, apparently was successful in evading disaster to his vessel from enemy submarines though attacked on three occasions.

Taking into consideration the facts as they have presented themselves, the Court finds that the master should have taken soundings when he received his radio bearing from Chebucto Head before rejecting it as incorrect; again before he altered course towards danger, and still again immediately he saw Sambro Light, and availed himself of further bearings from the radio station, and of Sambro Light. He might easily have hauled away from the light—which would have been the proper thing to do under the circumstances—as there could be no hurry in making port before daybreak in any event.

For the above reasons the Court, while finding Captain Ernest C. Hiscoe at fault for this casualty—crediting him, however, with his war record, and career as master in the past—will take a lenient view of the case, and only suspend his certificate No. 00551, for a period of three months from present date, March 8th, 1920.

The Court finds further, that Second Officer Samuel Blackmore, Master's Cert. No. 039,432—in whom the master apparently had implicit confidence—was lacking in his sense of responsibility and duty, and must censure him for not suggesting to the master the necessity of verifying the ship's position by soundings and further radio bearings at the above mentioned periods.

The Court further finds that the deplorable loss of life was not in any way due to the neglect of any individual or individuals; but was caused during the transfer of those remaining on the "Bohemian" to the tug "Roebling" in dark hours of a very cold morning by means of rope ladder and ice-coated davit ropes, etc.

The Court wishes to impress upon navigators the desirability of more extensive use of the radio bearings which are obtainable from the various Direction Finding Stations, and are undoubtedly a distinct advantage to mariners as a further means of checking their positions.

The Court might look with askance upon the disappearance of the log books, slate, and other papers, were it not for the master's sworn statement that he also lost his certificate at the same time.

The Court desires to extend its sympathy to the relatives and dependents of those men who lost their lives in this unfortunate disaster.

Read in Open Court at Halifax, N.S., this 8th day of March, 1920.

Sgd. J. BLANCHARD HENRY
Commissioner.

Concurred in by
Sgd. NEIL HALL
Sgd. C. O. ALLEN.
Assessors.

Smelter Purchased. — The Ontario Smelters and Refiners Ltd., of Chippawa, have purchased a smelter, located in Welland, formerly operated by the Metals Chemical Company. The new owners expect to recover metals from the dump left by the previous owners. New machinery and alterations to plant will be necessary at Welland, and work is now going on for these purposes.

Educational Items for Future Officers

A Series of Questions and Answers on Subjects Pertaining to Seamanship—Rule of the Road—The Use of the Chart—These Articles Will Appear Monthly

Continued from last month's issue.

Ship's Business

THE first consideration of the master in connection with a vessel which meets with disaster is that of the safety of the lives on board. I do not take it upon myself to lay down any course he should pursue in this regard, for he would act as circumstances would allow; his second consideration should be the safety of the property entrusted to his care. If he applies the test to himself, putting himself in the place of the owners of the vessel and cargo, and of the underwriters as well, any error which may be made will be purely one of judgment. No man can be perfect: all are liable to errors of judgment. Do the fair, manly thing, with straightforward action, and you need have no fear of your certificate being questioned, or that your insurance will not be paid.

Should your vessel become disabled at sea so as to require the assistance of another vessel, the question of the character of the assistance naturally comes to the front at once; next, whether the service about to be rendered to the vessel in distress is ordinary towage or salvage. If simply ordinary towage, the ordinary rate will naturally apply; if other than ordinary services are required it is of the utmost importance that the master of the distressed vessel should make every effort to come to an agreement with the master of the salvaging vessel for a moderate compensation. If he finds the latter will not make what he considers a reasonable agreement, the best course to pursue is to make no agreement whatever, but simply have the vessel taken hold of, the question of remuneration left to the owners of the vessels; this agreement will go to arbitration or to the courts, as the case may be. I think I am correct in saying that it cannot be too strongly impressed upon ship masters that no agreement at all is infinitely better than an agreement for an excessive amount. If a vessel has to seek a port of refuge, the first thing for the master to do is to call upon the underwriters' representatives, if there be any, and consult and advise him in every step that is taken. This will strengthen his position materially and enable his owners to make the proper collections from underwriters, and other interested parties, very much more rapidly than if it is *not* done.

Immediately upon the arrival at the port of refuge, the ship's master should communicate with the owners by telegraph or cable, if possible, stating clearly the nature and extent of damage done so far as known. It is worth remarking here that a too frequent mistake of masters of distressed vessels in communicating with their owners is to condense their messages in order to save money, and they are practically unintelligible when received. Always avoid any such economy as this. What does it matter about two or three dollars? Although this is generally understood amongst ship masters, yet when it comes to action it seems to slip so many minds. Again, I would say that in order that owner and underwriter may co-operate, they should be given complete and prompt information in case of disaster. The question of a few dollars in the cost of cablegrams cuts no figure whatever. Having conversed with the underwriters' representative, and communicated with owners, the next step should be to call a survey. Here again the underwriters' representative should be advised and the greatest care used in the selection of surveyors. The master should continually bear in mind that if there is a local representative of underwriters he can be of the greatest assistance because of his knowledge of men and conditions. Of course, with these suggestions, I realize there are many masters who do not know anything about the insurance on the property which they have in charge, which I think wrong, but at any rate, these pointers will assist him. His owners may not know what is the best thing to do and may of course just advise him that they would come up and look over it themselves. But again, the master may be the owner and so these points may be of valuable assistance. Then, again, you are only dealing with a representative and not with the company which in all probability would be at some distance.

Surveyors having been selected, and their recommendations received, the next step should be again to communicate with the owners, advising them fully as to what is recommended by the surveyors and noting, at the same time, the probable cost of repairs, discharging, storing and reloading cargo, etc. In the event of the master receiving a reply from his owners instructing him to proceed with the repairs, he should then act promptly and ask for tenders for repairs, if tenders can be obtained; if not, proceed with the work in the best manner possible. When the vessel is again ready for sea, and the bills paid, the master should have the surveyors go over all the bills and mark opposite each item whether the damage was directly due to the accident or to ordinary wear and tear. This is of great importance, in order that the adjusters can promptly and correctly aggregate and proportion all the bills. From experience I could tell that frequent failure to have this done leads to endless trouble and confusion between underwriters and owners. All bills must be first approved by the surveyors, and then by the underwriters' agent.

The fact should not be lost sight of that every insurance policy contains the following clause:—"If there be an agent of the underwriters at port of repair, this agent must approve of all bills or they will not be paid by the underwriters." Do not forget also in this connection that immediately upon arrival at port of refuge or at port of destination, that damage of cargo protest should be noted and extended in detail at the first opportunity; furthermore, if the vessel be under average, upon delivery at port of destination, the master, for the protection of all parties to the adventure, should secure the consignee's signature to the average bond, before delivery of the cargo; the form used in connection should be Lloyd's average bond. In the event of a vessel arriving in port so damaged as to make repairs questionable, the master should at once communicate with his owners so that they in turn may consult with the underwriters. In case of being stranded and total loss, masters should govern their actions with the same rule as to putting into a port of refuge, and guide himself by what he would conscientiously do if he were the owner and uninsured. I would ask you to bear in mind that if the vessel is sold, as being a total wreck, and afterwards refloated and put into commission it is a strong reflection on his judgment and capability and one that no master can ever overcome no matter how good his subsequent record. Sometimes we have cases where the ship is a total wreck but the cargo can be saved by moderate expense, and here the master should realize that the cargo belongs to third parties and an unjustifiable sale is sure to make trouble, particularly for himself and the owners.

In writing on Ship's Business, there are a few more pointers we should all know something of: Charter Parties, Bills of Lading, Certificates of Register, Bills of Health and Manifest. A document giving full particulars of the cargo on board such as marks and numbers, the names of the shippers and consignees, and master's name, the tonnage of the vessel, ports of loading and discharging, list of stores, crew and passengers and the manifest is made out from the bills of lading; in reality it is the master's duty to see that the marks on the manifest are properly made out and he should sign it. This matter is now left to the purser and others, but, of course, some ships do not have a purser.

Invoice.—An account of goods shipped, showing the cost and charges, such as freight, insurance, etc., with their marks and numbers, the name of the vessel, master, port of destination and name of consignee.

Bottomry Bond.—A bond given by the master on the security of the ship to pay for repairs, or for necessary expenditure, to enable him to continue the voyage; it must be advertised for the lowest tender taken. If a second bottomry is effected during one voyage, the last is paid first. These bonds are paid for if the ship arrives safe; if she is lost, the lender loses his money and interest.

Jettison.—Throwing overboard cargo or cutting away masts, etc. To render this warrantable, it should be done in case of immediate danger in a gale, to lighten the ship, or after getting aground, for the purpose of getting the ship off.

General Average.—Is when something is sacrificed by the master for the preservation

of the remainder; for instance, throwing cargo overboard, cutting away masts, slipping cable, etc. The owners of the ship, cargo and freight, less wage and victuals, each pays in a proportion to value. General averages are generally paid when the ship arrives at the port of destination.

Average Bond.—Is an agreement signed by the master, consignee and all the merchants who have goods in the ship, binding themselves to pay their proportion of the loss by general average, when adjusted by the average adjuster. It must be signed before the cargo is delivered, and handed over by the master to the average adjuster.

Particular Average.—Is a term used to express partial loss or damage to either ship or cargo. When the ship is insured, it is usual to insert a clause in the policy, "Ship and freight warranted free from average under a certain percentage unless general or the ship is stranded." This means that the damage must amount to a certain percentage upon the value that the ship or cargo is insured for, before it will be under particular average, or before any claim can be made upon the underwriters.

Protests.—After the ship's arrival in port, the master should show to a notary public or in a foreign port to the consul, a note of protest against winds and weather that caused damage to the ship and cargo. The protest need not be extended until it has been asserted, the nature and amount of damage, if any. It is the master's duty to see that the mate writes daily in the log-book, all the gales, and accidents and damage encountered and the result of such.

Putting into port in distress, masters should report the ship to the consul, call a survey of two competent persons, generally ship masters; telegraph to owners, and if damage is serious, await his instructions if any prospect of getting them in a reasonable time; if not, appoint a respectable agent to assist you to transact the necessary business, advertise for estimates for repairs, and accept the most approved. If necessary, warehouse the cargo and proceed with the repairs. When the repairs are completed, call the same surveyors, get their report that the ship is seaworthy, extend the protest and re-ship the cargo. It should be particularly noted that the surveyors' report contains the nature of the damage, whether it is from bad stowage, water or other causes. It must be written out in duplicate and signed by the surveyors and given to the parties calling the survey.

The surveyors must certify so that the ship will be free from claim for damage, that the cargo was properly dunnaged and stored and that the damage was caused by water through stress of weather.

You can always get money for repairs by drawing a bill on the owner, or as a last resort, by selling part of the cargo by auction. Before leaving the port, full particulars must be sent to the owners, together with a protest report of survey, estimates and vouchers, three sets of these documents must be obtained from the parties, signed by them and their signatures verified. If you are in some distant port, it would be well to send by different mails, and you should also send a statement of all the money drawn and the amount of cash advanced to each member of the crew. This is for your own protection so that if anything happens to you your wages should not be interfered with. In case of any difficulties, the law does not compel you to consult Lloyd's agent. The master is agent for all parties concerned, no other person except the owner can supersede him unless he misconducts himself.

Pratique.—Pratique means permission for master and passengers, if any, to go on shore on ship's arrival at a foreign port, if the master has a clean bill of health; if not, after having performed quarantine.

Jerk Note.—A certificate from the custom office when the whole is cleared of inward cargo; these terms will perhaps be a little graphic, but you will gather, I think, from what I have said, the meaning of the terms as they are applied to your particular case. Of course, we realize that these terms include ocean business as well as lakes. I am not sure if you are aware that the Canadian Government now grant ocean certificates and they have made two appointments for examiners in the Dominion. These examiners also examine for Inland, Coast-wise, Tug, or any other grade required by the candidate.

NOTICE TO MARINERS
No. 8 of 1920
(Inland No. 2.)

All bearings, unless otherwise noted, are true and are given from seaward in degrees from 0° (North) to 360°, measured clockwise, followed by the magnetic bearing in degrees in brackets, miles are nautical miles, heights are above high water and all depths are at mean low water.

ONTARIO—MICHIGAN

(19) Lower Detroit River—Rules and Regulations for Navigating the Amherstburg and Livingstone Channels.

While the Livingstone channel is being widened the following rules and regulations will go into effect on the opening of navigation, 1920, and will remain in effect until further notice. Rules 1 to 5, published below, cover the regulations, which may be summarized as follows:—

Amherstburg channel is to be used by:

All downbound vessels.

All upbound loaded freight vessels.

All upbound light vessels with more than one vessel in tow.

Optional for upbound passenger vessels.

Optional for vessels under 100 gross tons and for vessels making local stops.

Livingstone channel is to be used by:

All upbound light vessels when alone or with but one light vessel in tow.

Optional for upbound passenger vessels, but such vessels are subject to the rules governing this channel.

Optional for vessels under 100 gross tons and for vessels making local stops.

Time interval of five minutes required between vessels, and no vessel to pass anoanother between Bar Point light vessel and Ballards Reef.

All vessels using Amherstburg channel will enter or leave Lake Erie via channel to the east of Detroit River lighthouse. All vessels upbound for Livingstone channel will leave Lake Erie via the channel to the west of Detroit River lighthouse.

Caution.—Upbound vessels using Livingstone channel will keep well to its westerly side where said channel unites with Amherstburg channel north of Detroit River lighthouse.

Upbound vessles leaving Livingstone channel must cross the path of downbound vessels in the vicinity of Ballards Reef. Downbound vessels have the right of way, but Masters of both downbound and upbound vessels using Amherstburg channel should be unfailing watchful for upbound vessels from Livingstone channel. All vessels in this locality should navigate under complete control and with the utmost caution.

Rule 1. No vessel of 100 gross tons or over shall navigate the Livingstone channel at a rate of speed greater than twelve statute miles per hour between its junction with the Amherstburg channel at Ballards Reef and the Bar Point light vessel; nor the Amherstburg channel at a rate of speed greater than twelve statute miles per hour between the south end of Bois Blanc Island and the North gas buoys at Ballards Reef, and where the width of either of these channels is restricted by improvements in progress, the speed through such restricted width of channel shall not exceed eight statute miles per hour.

Rule 2. No loaded freight vessel, whether alone or in tow, shall pass through Livingstone channel, in either direction. All downbound vessels, all upbound loaded vessels, and all upbound light vessels with more than one vessel in tow, shall pass through the Amherstburg channel and the channel to the east of Detroit river lighthouse. All upbound light vessels, whether alone or with a single vessel in tow shall pass through the channel to the west of Detroit river lighthouse and through the Livingstone channel, except as stated in Rule 3.

Vessels under 100 gross tons, and vessels making local stops along these routes, are exempt from this rule.

Rule 3. Upbound passenger vessels may use either the Amherstburg channel or the Livingstone channel, but if they use the latter they shall be subject to the rules governing that channel.

Rule 4. All light-draft passenger and freight vessels using the Amherstburg channel in either direction shall pass through the auxiliary channel (280 feet wide and 14½ feet deep), to the eastward of the improved channel at Ballards Reef.

Rule 5. No vessel shall pass another vessel bound in the same direction in that portion of Livingstone channel between its junction with Amherstburg channel at Bar Point light vessel and at Ballards Reef, nor at any other portion of either Livingstone and Amherstburg channels where the width of the channel is restricted by improvements in progress. Between any two upbound vessels navigating that portion of Livingstone channel from Bar Point light vessels to Ballards Reef, there shall be a time interval of not less than five minutes.

Tugs without tows and vessels under 100 gross tons are exempt from this rule.

Authority.—Departmental records.

Publication.—U. S. Lake Survey Bulletin, No. 28, pages 373 and 374.

Departmental File.—No. 28025.

(No. 10 of 1920
(Pacific No. 3)

BRITISH COLUMBIA

(23) Canadian Lists of Lights and Fog Signals—New Edition

A list of all the lights and fog signals on the Pacific coast of the Dominion of Canada, corrected to the 1st April, 1920, has just been published. Copies will be supplied to mariners free on application.

N. to M. No. 10 (23) 20-3-20.

Departmental File: No. 28502.

BRITISH COLUMBIA

(24) Vancouver Island—Esquimalt Harbor Entrance—Fisgard Island Light—Illuminated Arc—Correction to List of Lights

Postion.—On Fisgard Island, west side of entrance to Esquimalt harbor.

Latitude N. 48° 25′ 52″ Longitude W. 123° 26′ 48″

Correction.—The remarks in the existing List of Lights should be cancelled and replaced by the following:

"Visible from all points of approach by water with a red sector between 195 and 332°. To clear Scrogg rocks the light must show white when approaching from eastward."

N. to M. No. 10 (24) 20-3-20.

Authority.—Commander J. H. Knight, R. N. Hydrographic Survey, Victoria.

Admiralty charts.—Nos. 1897a, 576, 2840, 2689, 1911, 1917 and 2531.

Publication.—British Columbia Pilot, Vol. 1, 1913, page 55.

Canadian List of Lights and Fog Singlas.—1920, No. 2272.

Departmental File.—No. 22272a and 28502.

ALASKA

(25) Revillagigedo Channel—Bold Island—Angle Point—Lighted Beacon Established

Former notice.—No. 18 (42) of 1919.

Position.—On point, on southwest side of Bold Island.

Character.—Group flashing white light shows a group of 2 flashes every 10 seconds, thus: flash 0.5 second, eclipse 1.5 seconds, flash 0.5 seconds, eclipse 7.5 seconds.

Light is obscured from 132° to 298°.

Elevation.—51 feet.

Description.—Small house.

Note.—The day beacon has been removed.

N. to M. No. 10 (25) 20-3-20.

Authority.—U. S. Dep't of Commerce, N. to M. No. 9 of 1920.

Admiralty chart.—No. 2458.

Publication.—Alaska Pilot, 1908, page 140.

A. JOHNSTON, Deputy Minister.
Department of Marine and Fisheries,
Ottawa, Canada, March 20th, 1920.

Pilots, masters or others interested are earnestly requested to send information of dangers, changes in aids to navigation, notice of new shoals or channels, errors in publications, or any other facts affecting the navigation of Canadian waters to the Chief Engineer, Department of Marine and Fisheries, Ottawa, Canada. Such communications can be mailed free of Canadian postage.

The work of regulating the flow of the St. Maurice River, by means of the Gouin Dam, was described at last week's meeting of the Engineering Institute of Canada by Mr. O. Lefebvre, the chief engineer of the Quebec Streams Commission. The work, says Mr. Lefebvre, had proved a great success, a total of 400,000 horse-power being developed on the St. Maurice River, with the possibility of an additional half a million more.

The British Manufacturers' Association, through their representative, Rafael de la Cova, who has recently come to Canada, is endeavoring to improve trade conditions between the two countries. Several conferences have already been held between Mr. de la Cova, the Board of Trade, and other business interests. In addition to his tour of Canada, Mr. de la Cova will visit many other countries in the interest of British trade development.

* * *

The appointment of consulting engineers by both the Canadian and American Governments marks a further step in the development of plans for the deepening of the St. Lawrence River between Montreal and Lake Ontario. Canada's representative will be W. A. Bowden, B.A.S.E., M.E.I.C., chief engineer of the Railways and Canals Department. Lt.-Col. Wooton, an engineer in the American Government service, will be the United States' chief consultant.

* * *

An extensive suite of offices in the Ottawa Building, Montreal, has been taken over by the British Trade Commission for Canada to provide more adequate facilities for gathering and distributing information to both Canadian importers and exporters, and also to British trade emissaries visiting Montreal. A large sample room and well-equipped library of Empire wide trade and technical papers has been provided for the convenience and education of business patrons.

* * *

Some experiments are being carried out near Lyons, at the confluence of the Rhone and Saone with a "toupie hydro-electrique," with the object of obtaining power from the river. It appears from an article in "l'Outillage" that the toupie, invented by MM. Gilbert, Planche and Aason, is virtually a totally immersed water wheel, supported by a pontoon floating in the stream. It is said that one wheel will give 25 horse-power and have an efficiency of 60 per cent.

* * *

The St. Lawrence Welding Company of Montreal has just about completed the new addition to their plant and recently purchased equipment will be installed within a week or so. In addition to their general line of welding and boiler work the company will be in a position to take care of every line of engineering work. The boiler and tank end of the business will be in charge of John Murphy, who has had 43 years of continuous experience in boiler work. He was four years with the Hall Engineering Works, two years with Burland and Johnson of Amherst, N.S., and thirteen years as foreman with J. & R. Weir of Montreal.

Repairs to the broken syphon beneath the Lachine Canal are progressing so favorably that the reopening of the waterway is anticipated about the first of May.

* * *

By-Law Carries.—The by-law to advance a loan of $25,000 for extending the plant of the Elliot & Whitehall Machine & Tool Co., Galt, Ontario, was approved by the electors. This firm have made very rapid strides since their inauguration in January 1918, when they started operations with three men. They have now a staff of 20 men, and figure on having employment for sixty men in the near future. The firm manufacture milling cutters, reamers, taps, hobs, etc. The loan will be secured by a first mortgage on the land and buildings of the company.

* * *

New Plant at Meaford.—The Meaford Steel Products Ltd. has taken over the premises of the Meaford Wheelbarrow Factory, the largest plant of its kind in Canada, which has been closed down since 1916. The new concern will make wheelbarrows, scrapers, warehouse trucks and platform scales, for which a number of orders have been already received. The officers of the new company are Mr. James A. Brown, London, president; E. S. Cleland, vice-president and manager; James S. Reynolds, Sault Ste. Marie, secretary-treasurer. The directors are George Fox, London, and Dr. F. A. Cleland, Toronto.

* * *

The Dodge Sales and Engineering Company, of Mishawaka, Ind., have issued several circulars dealing with their new heavy oil engine, which was formerly known as the "Burnoil." The engines are made in 12½ and 37½ h.p. units, and can be made in any combination up to 6 cylinders, thus giving 75 h.p. on the smaller sizes and 225 h.p. on the larger sized 6-cylinder engines. The engines operate on the Diesel principle, but an ingenious method of introducing the fuel charge has eliminated the necessity of high-pressure air for the purpose. This of course simplifies the engine considerably.

* * *

At a recent meeting of the Dominion Council of the Canadian Engineering Institute of Canada, held at the headquarters in Montreal, the question of revising the remunerative scale now in force was the chief subject of discussion, and, as a result of this meeting, it is expected that the executive will take some action regarding the economic welfare of the individual members of the society. It was pointed out that the Engineering Institute was in no sense a union, but a body of Canadian professional men, organized to carry out its work so as to advance the professional interests of the members, by means of papers and addresses, and in other ways, including such attention to material conditions as might be warranted.

MARINE NEWS FROM EVERY SOURCE

MARINE

Windsor.—The death is announced of Capt. J. C. Burns, one of the eldest lake sailors, at the age of 81. The deceased passed away at his home in Anderdon Township, and is survived by ten children.

St. Johns, Nfld.—The sealing season this year has been a total failure, the catch being the lowest for a generation. The combined catch of the four steamers, "Sable Island," "Neptune," "Eagle" and "Thetis," was only 20,456 seals. The total catch of the fleet is not expected to exceed 40,000 seals.

Toronto.—Toronto waterfront is showing all the signs of the nearby opening of navigation. Steamers are being painted up, freight sheds are receiving goods for shipment. The first trip across the lake has been made. Ferry boats to the Island will soon be starting, and the C. S. L. boats on the Niagara route will start their season by the end of April.

New Glasgow. — The Nova Scotia Steel & Coal Company successfully launched the "Canadian Miner" from their yard on the Pictou River recently. This is the sixth vessel to be launched from this yard. The steamer is of the 2,800-ton class. The christening honors were performed by Mrs. McMillan, wife of the superintendent.

Sydney.—The Cabinet is still considering the question of the Sydney Dry Dock. It is understood that there is a very good chance of a favorable decision, in which case construction would be begun at once. Mr. Burchell is keeping in close touch with the situation, and is spending a good deal of time in Ottawa while the subject of the dock is before the Cabinet.

Sarnia.—The steamers of the Northern Navigation Company will use Point Edward as a calling port instead of Sarnia owing to a change of schedule. This was announced by the manager, Mr. Gildersleeve. He also announced that their steamer "Noronic" would leave Sarnia on May 1 to proceed to Detroit, where she will be utilized as a floating hotel. She will remain there until the opening of the season on June 10th.

Ottawa.—Officials of the Marine Department state that the St. Lawrence River will be open to the sea by the 19th of April. Although the past winter has been so severe, the opening date will be about the same as that of last year.

Vancouver.—The duty on fuel oil coming into Canada is hitting the owners of oil-burning vessels on the B. C. coast. Steamers running out of Seattle can obtain their oil at $2.03 per barrel, while the Canadian vessels have to pay $2.70 for the same oil in Canada. The owners state that the rise in price during the last year is sufficient handicap, without the added duty.

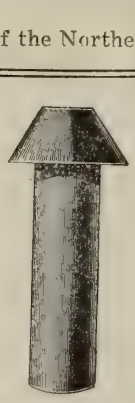
Victoria, B.C. — The Victoria Shipowners Ltd., have concluded the agreement with the Ottawa Government for the loan with which to build four wooden barquentines in the Cholberg Shipyards. The agreement has been signed, and the vessels, which will cost $250,000 each, will be built right away.

Brockville. — The Canada Steamship Lines have sold the steamer St. Lawrence to the Kingston Navigation Co., which is composed of Kingston business men. The vessel will be placed on the Kingston-Ogdensburg run during the summer. The St. Lawrence is well known on the river, having been for many years one of the crack boats of the Folger fleet when that line was supreme in the Thousand Islands district. The vessel will be transferred to Canadian register.

Vancouver.—Much dissatisfaction is felt by the officials of the Genoa Bay Lumber Company over a decision of the Government steamship agent that forbids the loading of the Canadian Government steamers at Genoa Bay. The reason given is that it is not a safe harbor for large steamers. The alternative is that the lumber will have to be shipped to Vancouver by scow and then loaded on to the steamers. The mill officials claim that they have excellent loading facilities at Genoa Bay, and are taking up the question with J. C. McIntosh, M.P., in an effort to have the matter adjusted.

Vancouver. — The Union Steamship Company of British Columbia have called for tenders for a new steamer, which will be operated on the Prince Rupert-Vancouver run. The vessel has been designed by Henry Darling, naval architect and consulting engineer of Vancouver. The leading dimensions of the vessel will be: Length overall, 251 ft. 6 ins; between perpendiculars, 240 ft. 6 ins.; breadth moulded, 37 ft. 3 ins.; depth moulded, 16 ft.; depth to awning deck, 23 ft. 6 ins.; mean draft loaded, 13 ft. There will be accommodation for 98 first-class and 32 second-class passengers, while standee berths for 200 steerage passengers will be available.

That Shipping Merger.—The merger of shipping, shipbuilding and steel making enterprises that has been so long talked of, is again to the fore, and it is confidently stated that the Dominion Steel Corporation, the Nova Scotia Steel & Coal Co., the Canada Steamship Lines and several of the leading shipbuilding interests will amalgamate. After consolidation, the ramifications of this enterprise will be world-wide.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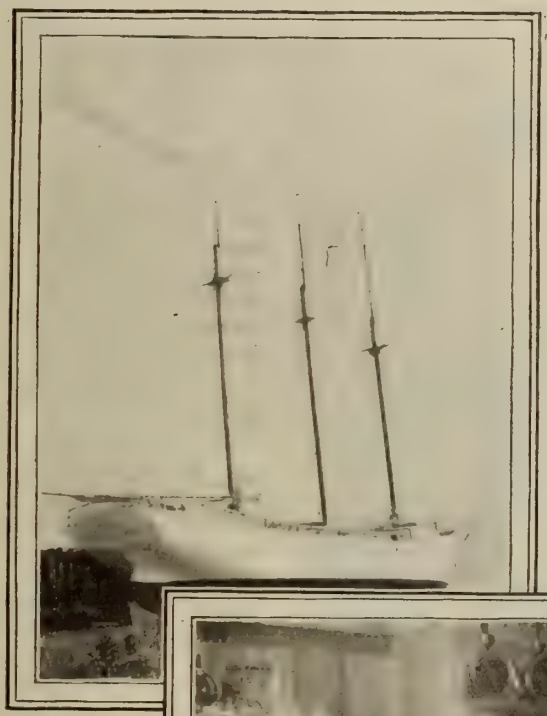

Auxiliary Motor Schooner "Samuel Courtney," 1918, equipped with 2-100 H.P. Fairbanks-Morse type "C.O." Semi-Diesel Crude Oil Engines.

Twin Screw, 7 Knots, 531 Gross Tons, 441 Net Tons, 171' long, 35' beam. Geo. M. Barr, Owner; Sam'l M. Courtney, Master; O'Brien Noel, N.S., Builder.

Fairbanks-Morse C.O. Engines have proved their economy, made possible by their using low priced fuels, and now the long distance speed record has been established. Each C.O.—30 to 200 H.P.—gives perfect regulation under all loads.

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PONTOONS CARRY PORTABLE PNEUMATIC CAISSON

A portable pneumatic caisson mounted upon a pair of pontoons and designed for the recovery of diamonds from the deep pools of the river Naal, is described in the "South African Mining Journal."

A metal cylinder or bell having a dome roof, which is surmounted with a tubular shaft in sections to suit depth of water to be worked, is terminated by an air-lock chamber surrounded by a water ballast tank. The dome roof of the bell is provided with means of securing, and at will releasing, a quantity of solid ballast. The tubular shaft is furnished with external runners which engage in rollers or guides attached to the deck of a pontoon or raft which carries an engine, air compressor and centrifugal pump, and possibly plant for the treatment of the gravel or material recovered. The air-lock chamber is provided with the usual manhole door and equalizing valve, together with an air-lock chute for discharging gravel; a special door closing gravel is deposited in the kibble or skip hoisted to air-lock or elevated direct above water level to the deck of the pontoon.

Method of Operation

Sufficient solid ballast to partially submerge the bell is placed on the dome roof, water ballast is then pumped into the tank surrounding the air-lock in order to sink it and hold it securely on the river bed or sea bottom, and the gravel is elevated to the surface by pump or ejector direct, or hoisted to the air-lock and thence discharged through the air-lock chute projecting through the water ballast tank. The bell, or caisson proper, is fifteen feet in diameter, five feet high, and has a cone roof rising to eight feet six inches; the interior is fitted with electric light in a water-tight fitting, and has a telephone communicating to the air-lock and engine-room. A specially-designed hydro ejector with a flexible suction is installed for clean-up purposes. The apex of the cone roof is surmounted with an M. S. collar-piece to which the various lengths of the shaft are bolted. The shaft is two feet nine inches interior diameter and is made in lengths varying from five feet to twelve feet; each length is furnished with ladder rungs and steel runners for skip, also with an air-pipe and five core armored cables with G. M. couplings for electric light, telephone and signal bells. The air-lock is six feet six inches in diameter and six feet six inches high; is fitted with the usual manhole and shaft doors, equalizing and relief valves, and is placed inside the water ballast tank, which is ten feet ten inches in diameter. Through the wall of the air-lock chamber and ballast tank a gravel chute projects at an angle of 45 degrees; this is closed at either end by air-lock doors, the outer one being of special construction fitted with a positive interlocking device which prevents its being opened until the inner door is closed. An Ingersoll air-hoist, operating a ½-ton skip, raises the gravel from the caisson and tips into the chute, which has a capacity of 1¼ tons. From this chute the gravel is discharged into a bin on the deck of the pontoon, and thence elevated to a trommel, whence it is delivered to gravitator. The pontoons are 37 ft. x 10 ft. x 2 ft. 6 in. and are connected by platform decks 37 ft. x 10 ft., thus forming a square, in the centre of which is a 17 ft. x 17 ft. opening to admit of the caisson being raised for transit in shallow water. A heavy gantry standing on columns is rigged for the purpose of raising and lowering the caisson. The deck plant consists of a vertical boiler, Laval steam turbines, air-compressor and receiver.

MARINE

Goderich.—Goderich harbor is now clear of ice, and there is no ice to be seen within the range of vision on the lake. The winter fleet of grain carriers has been fitted out, and the vessels will all be in trim to sail when the insurance comes in force on April 15.

Chicago.—According to the United States Weather Bureau, navigation on the Great Lakes should be open about April 10. The icefield at Duluth which extended for twenty miles has decreased to four miles in places and seven at the widest part, while the ice at the Soo and other points is rapidly weakening.

Toronto.—The Canada Steamship Lines' steamer "Macassa" again opened navigation between Hamilton and Toronto 24 days later than last year's date. During the last ten years this vessel has had the honor six times. The captain was presented with a high hat in honor of the event, an annual custom.

Sault Ste. Marie.—Ice conditions are such that it is expected navigation will be open by April 10, the recent warm rains having helped a great deal in softening the ice. Whitefish Bay is already partly clear. The steamer Charles Heiden has made the trip up through Lake St. Clair, being the first steamer of the season to make this voyage.

Toronto.—It is quite probable that the new steamer for the Canada Steamship Lines will be built in Toronto. She will be for the Toronto-Niagara route and will be 120 feet longer than the "Cayuga" and will have a capacity of 4,000 passengers. The proposed vessel will be the second largest passenger steamer on the Great Lakes, and if constructed in Canada will be the largest passenger steamer ever built in a Canadian yard.

Vancouver.—The Canadian Merchant Service Guild have sent a strong telegram to Hon. C. C. Ballantyne regarding the competency certificates for masters and mates of ships up to 750 tons, a bill affecting which is now before the house. The Guild strongly protests against any lowering of the standard of certificates, and further urges that the standard ought to be raised to that of the British Board of Trade. The statement in the bill that there is a shortage of masters and mates is denied by the Guild, which states that the reverse is the case.

Big Dock for Kingston.—The Collingwood Shipbuilding Company is preparing to make big additions to their plant at Kingston. A 750-foot dry dock is projected, and representatives of the company waited on the Mayor of Kingston and the Utilities Commission in connection with the plan. It will be necessary if the scheme is carried out to remove the city pumping station to another site.

Quebec.—It is reported that the local agency of the Department of Marine and Fisheries and the Quebec Harbor Commission will amalgamate. This would enable the stores of the Marine Department and their plant at King's Wharf to be moved to a place within the radius of the Harbor Commissioners' property. Besides the extra convenience and economy of such a plan, much more room would be available for the Transcontinental terminals on the water front.

St. John's, Nfd. — The British Admiralty has presented the Government of Newfoundland with four steamers for the public service of that country. They will be operated by the Shipping Department of the Government. The largest of the vessels is of 1,400 tons and will be operated in the general trade of the country, while the others will be employed as lighthouse tender in the mail steamer service and as rescue vessel on the south coast.

Port Stanley—A delegation from London, St. Thomas, and Middlesex and Elgin Counties will shortly have an interview with Hon. J. D. Reid in an endeavor to secure the needed improvements to Port Stanley harbor. The interview has been arranged by H. B. Cronyn, M.P. for London. The improvements, which were interrupted by the war, should be resumed, in the opinion of the residents of the district, and a vigorous protest will be made against the plans of the Government, which are held to be inadequate.

Sarnia.—It was stated by the Mayor of Sarnia that the White Star Line of steamers would shortly settle their differences with the city over the tax assessment and resume their calls at this port. The Mayor again affirmed that the matter was one between the Northern Navigation Company or the Grand Trunk and the city, and the company has the right of appeal to the Court of Revision. The assessment is placed on the Northern Navigation Company's wharf, and they in turn collect part of the cost from the White Star Line.

Sydney, C.B.—It has been definitely decided that this port will be the regular port of call for the steamers of the Canadian Government Merchant Marine on the Liverpool and Canada route during the summer. In the winter Louisburg will be the venue. The Dominion Iron and Steel Corporation have concluded arrangements with the management of the Government steamers to ensure quick handling of the products that they export to the United Kingdom. The "Canadian Ranger" has already taken a cargo, and the "Candian Miller" follows shortly.

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A MAN is coming all the way from London, England, to go over Niagara Falls in a barrel. The high cost of carbolic acid has driven folks to do many strange things.

* * *

THE KAISER was blamed for the war. Said Kaiser has been wearing wooden shoes and chopping trees in Holland for some months, but still there is a very respectable war story coming through from some corner of Europe, or Asia, or Ireland every day.

* * *

THEY do tell that X-ray photos of prospective brides' and grooms' diaphragms give a true test as to the suitability of the marriage. An X-ray of the groom's wad also gives a good indication of his ability to stand the racket.

* * *

PEOPLE in the Southern States are starting to deck themselves in blue overalls in order to combat the high cost of clothing. And so overalls 'opped from $2 to $6 per pair. The man who can swat Old Man Hicost right on the jaw has not yet arisen in the land.

* * *

THE RIVERS of Alaska are in danger of being robbed of their greatest asset, salmon, because no thought is given to re-stocking the streams. The timber limits of Canada are in danger of being sadly depleted of pulpwood because no good policy of reforestation is generally used. It is an easy thing to hand down a depleted heritage to coming generations.

* * *

YOU can't blame Mr. Galvanized Sheet for being a bit stiff and chesty as he passes out of stock at 12 cents per pound.

* * *

AGAIN this year, with the approach of May 1, it appears that the laborer considers he is worthy of his higher.

OXYWELDED TANK HOLDS TIGHT

One of the debris of a $400,000 fire that swept two blocks of Tampa's industrial district last December practically the only salvage was a 12,000 gallon oxywelded oil storage tank, which was afterwards found intact excepting for dents and scars that were later removed. Inspection showed that the oxywelded seams held tight at every point, no leak developing anywhere in the welds.

The tank contained 5,000 gallons of gasoline at the time of the fire. When the platform supporting it was consumed the tank fell to the ground, smashing a 5-inch outlet pipe. Roofing, beams and framework fell in and burned on top of the tank. Also a brick wall of an adjacent building collapsed, hurling tons of the brick on the conical top of the tank and bending the cone head below the level of the top tank ring. The tank was located approximately in the centre of the burned area.

This example of the strength and endurance of oxywelding is noteworthy because the usual shocks and strains to which the tank was subjected and because the tank itself is typical of oxywelded structures of the kind. The specifications of the tank are: Diameter, 16 feet; depth, 8½ feet (11 feet including the cone head); bottom ring, No. 10 gauge iron; top ring, No. 12 gauge iron; conical top, No. 14 gauge iron.

The tank was built by the American Welding & Tank Company, of Tampa, Fla., who have been engaged for a number of years in plate welding, building water tanks, smokestacks, pressure tanks, storage tanks, etc. The tank is in service to-day, as good as the day it was finished.

Interesting Judgment. — Mr. Justice Lennox has given judgment in the case of Hugh Perry against the British-American Shipbuilding Co., of Welland, for $1,231.74, damages for wrongful dismissal. The plaintiff was under contract to the defendant for 12 months as a riveter, the terms being that he received his passage from England and $60 a week for a fifty-hour week. The contract was not up till May but plaintiff was discharged in October, the company claiming that he was not an expert riveter, and furthermore had disorganized the yard. Justice Lennox found that the question of efficiency was not an issue, the plaintiff having been tried for two weeks before engagement by the company. He found no evidence that the plaintiff was disorganizing the yard, but thought that the fact of the plaintiff being so much higher paid than the other men would cause dissatisfaction.

Galt Foundry Extends. — The Galt Brass Company has started work on two additions to their plant, at an estimated cost of $50,000. The foundry building will be 60 by 140 feet, and the other 40 by 50 feet.

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150 GROWN SPRUCE KNEES, 4' x 3' 6", finished 8", 9" and 10" thick; thoroughly sound, ready for immediate delivery. For particulars, apply A. K., Marine Engineering.

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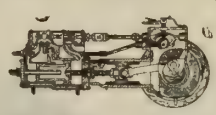

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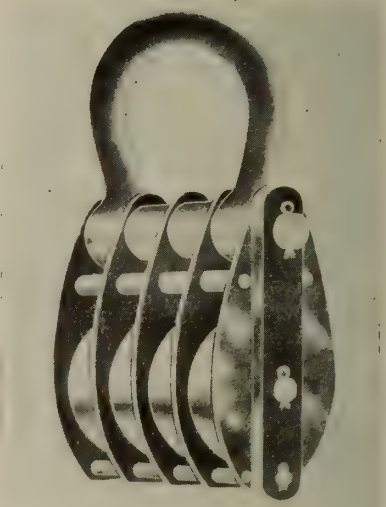

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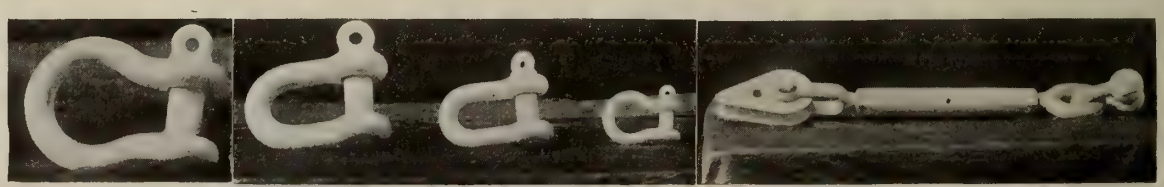

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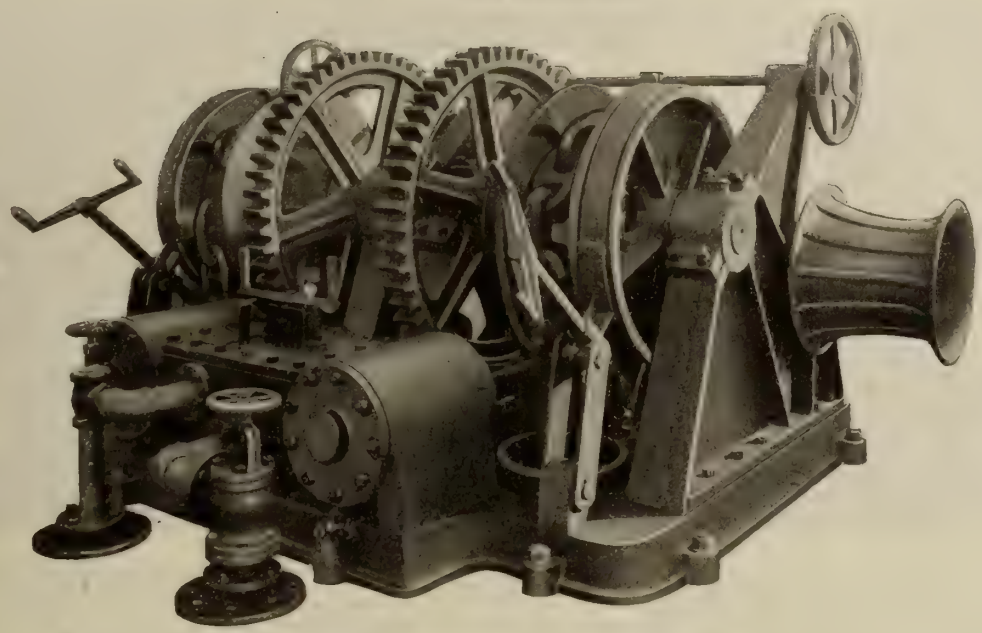

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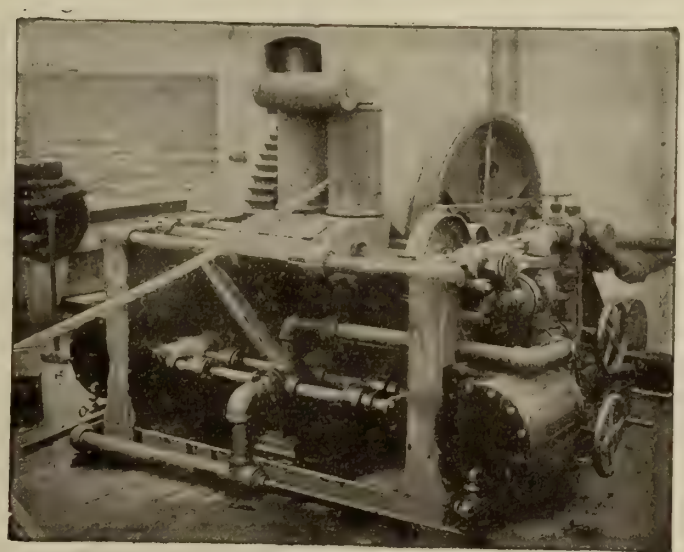

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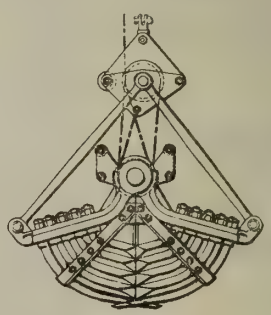

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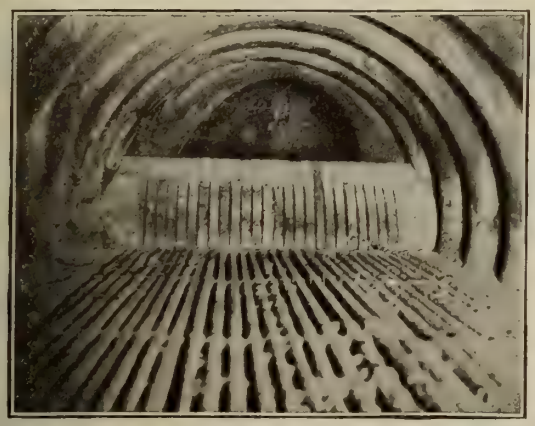

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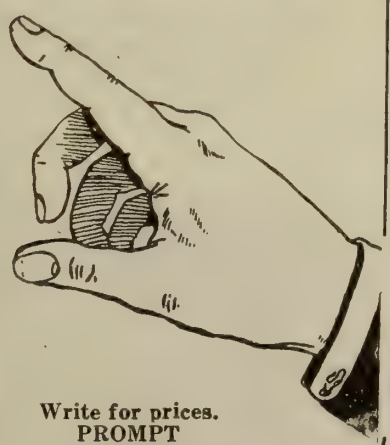

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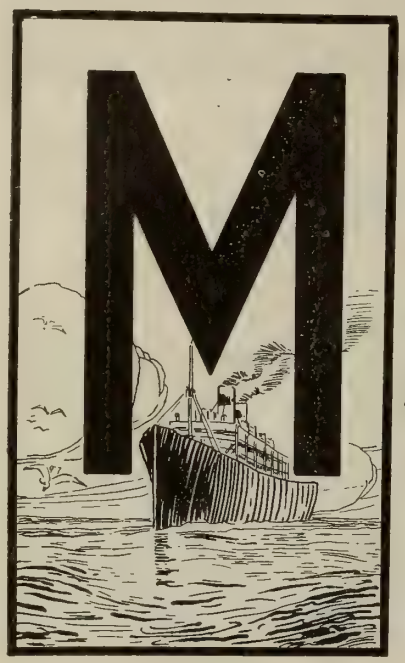

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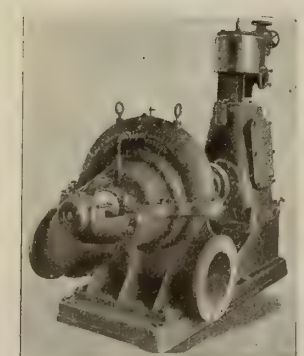

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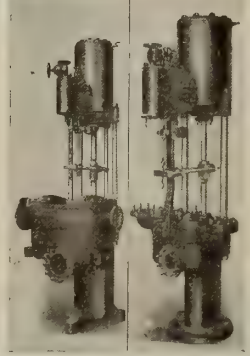

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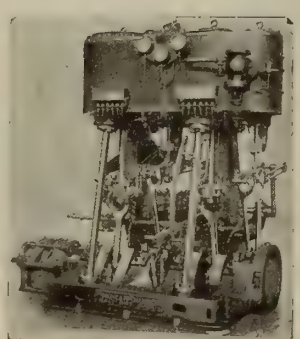

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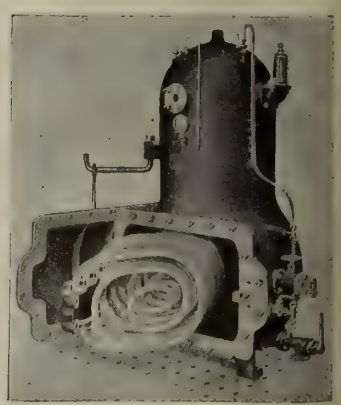

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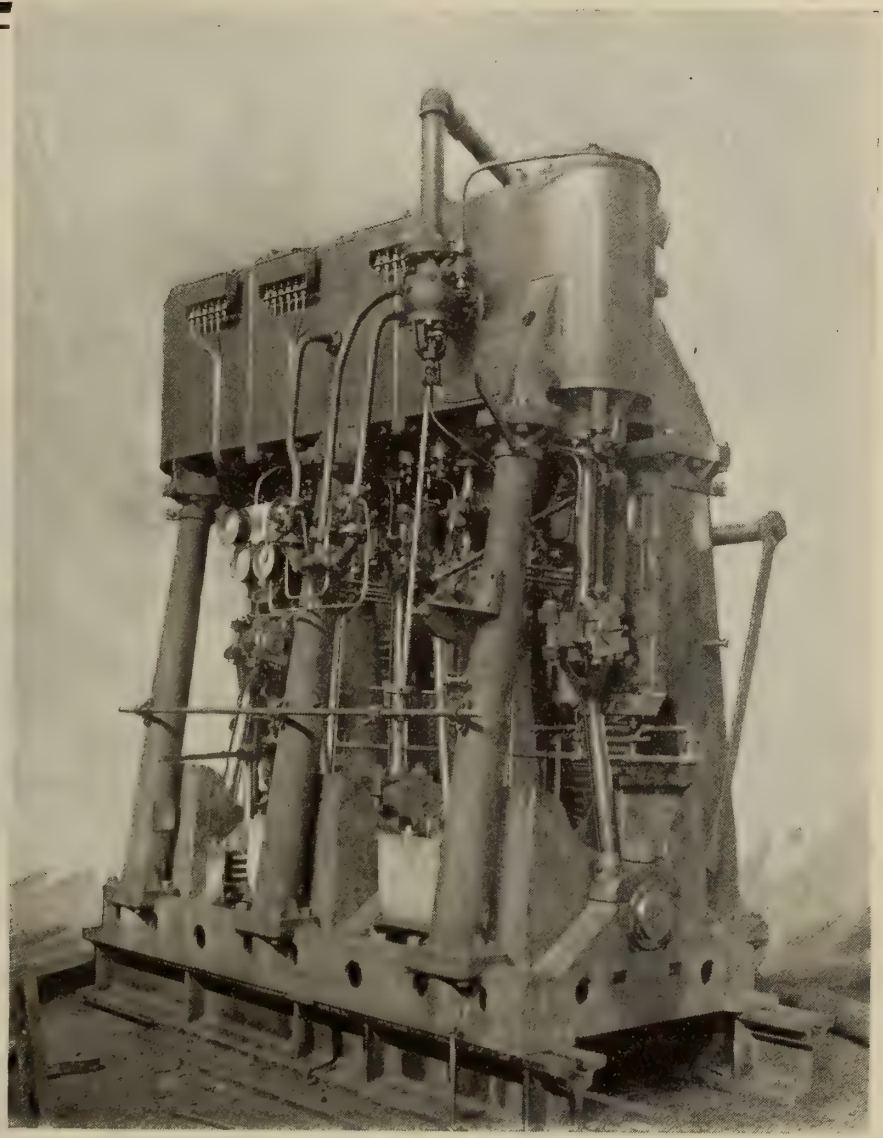

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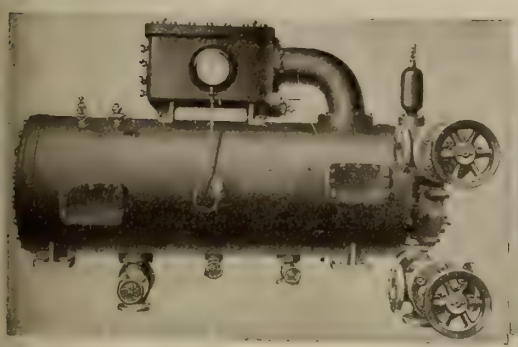

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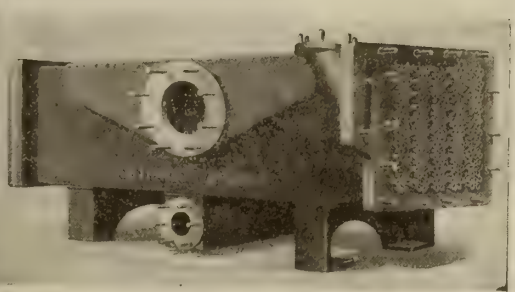
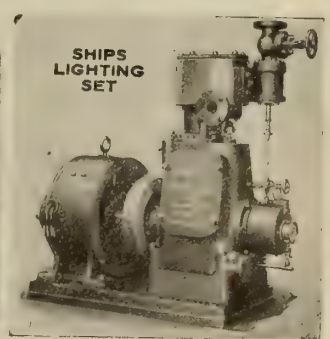


"Contraflo" Auxiliary Conden er



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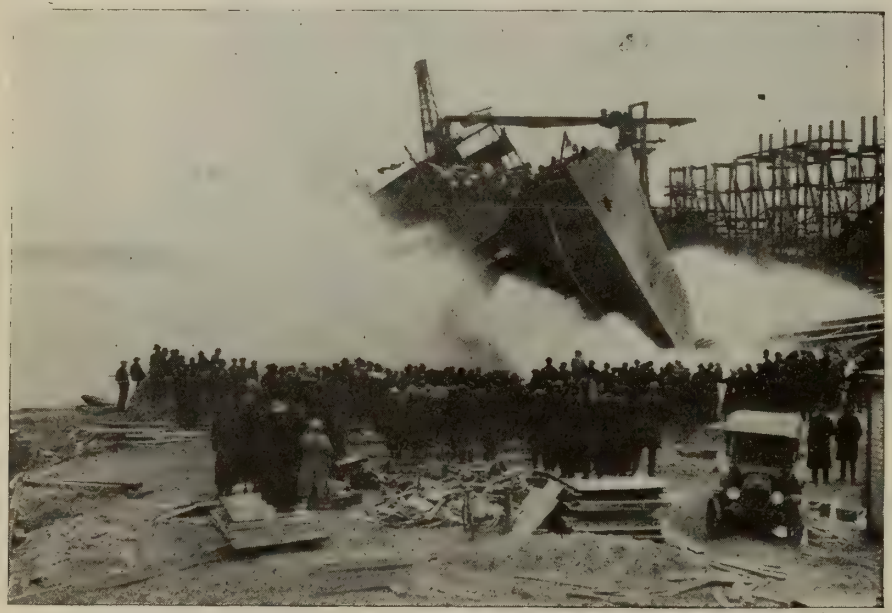

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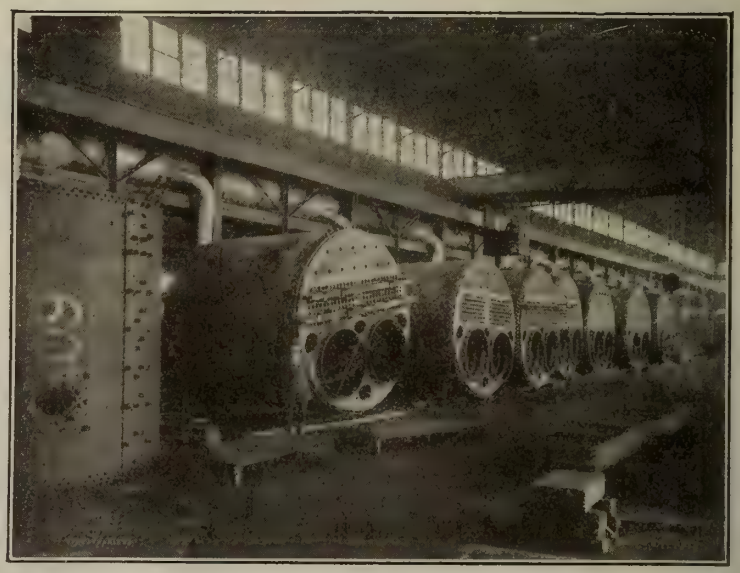

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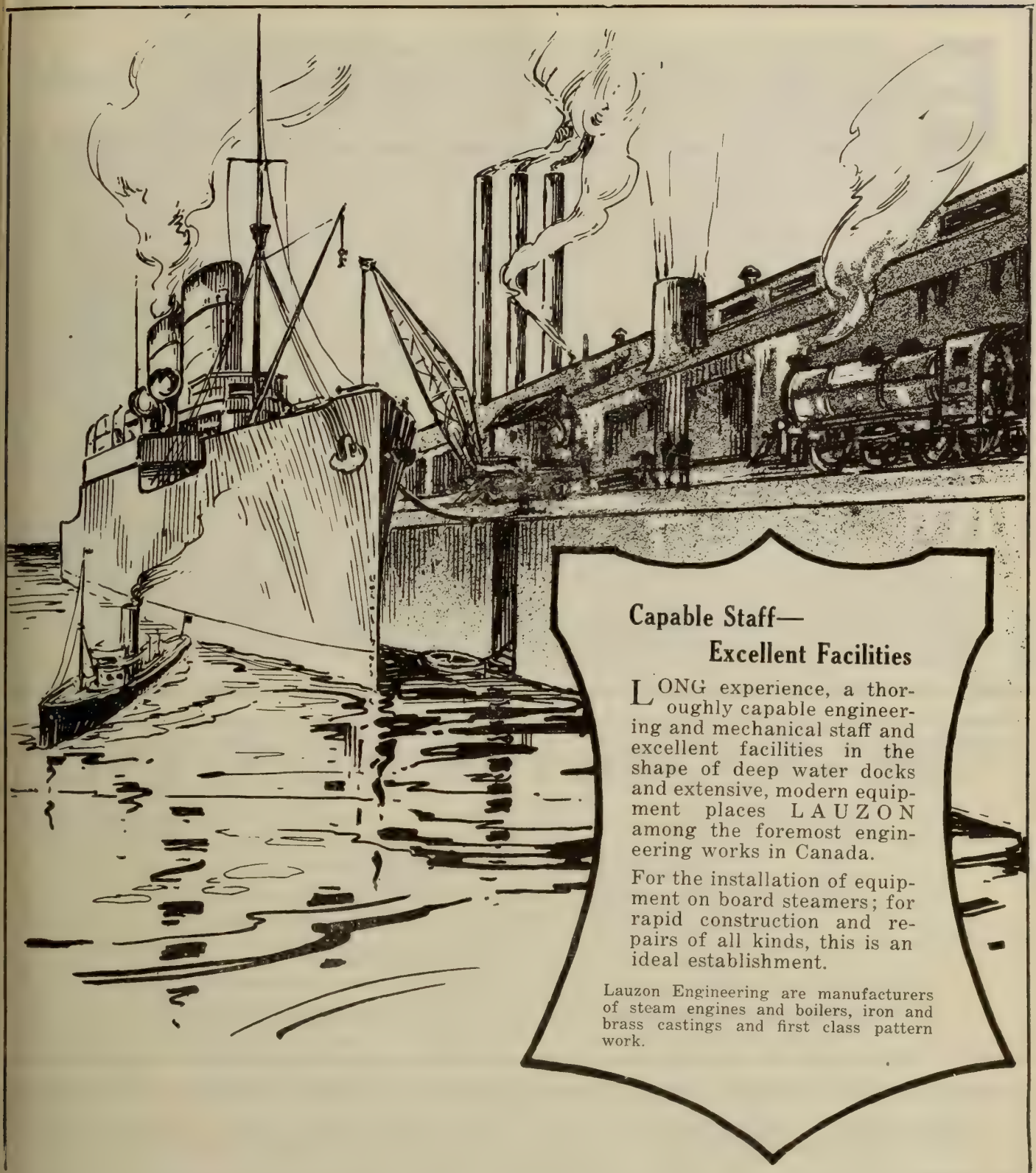

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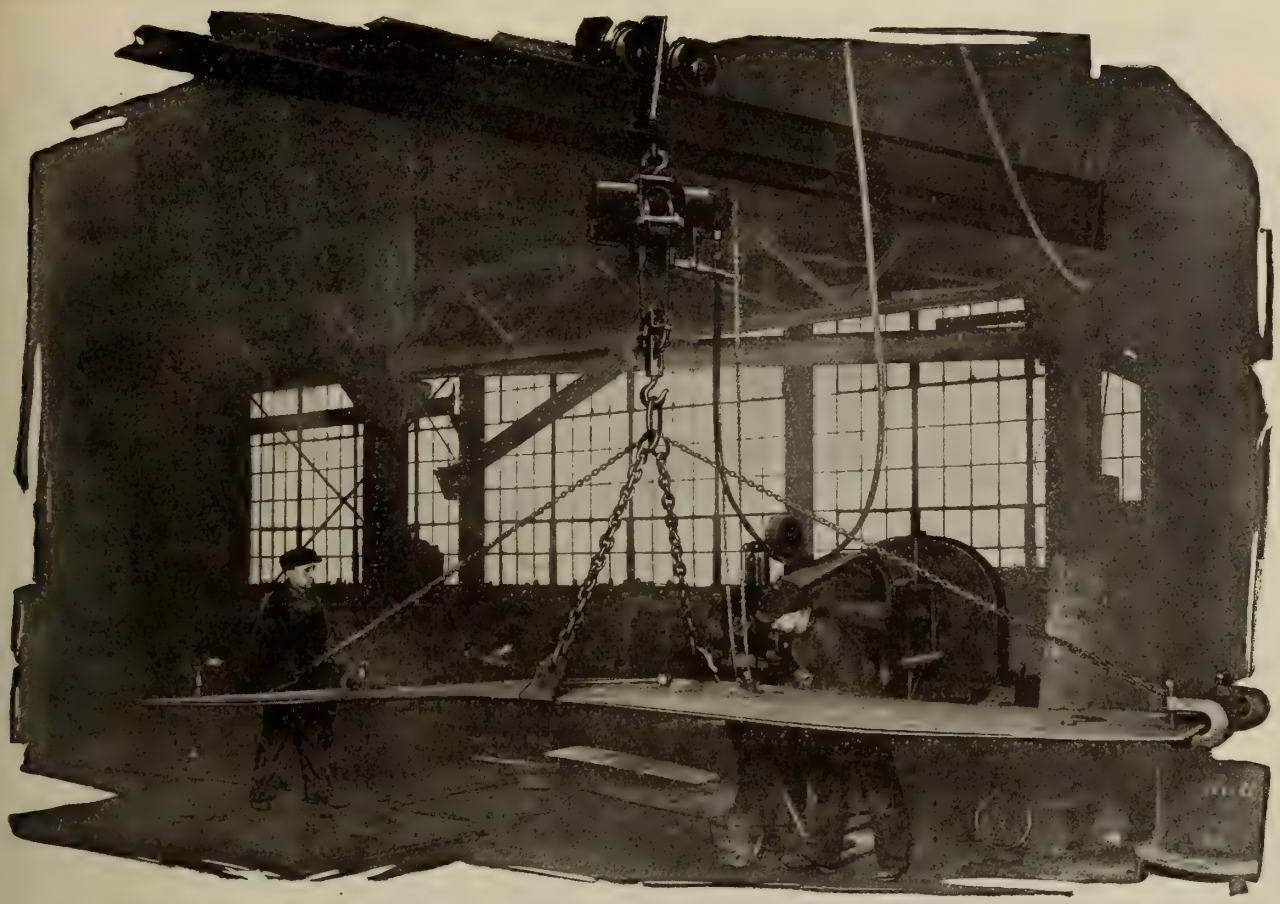

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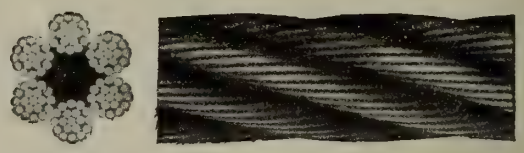

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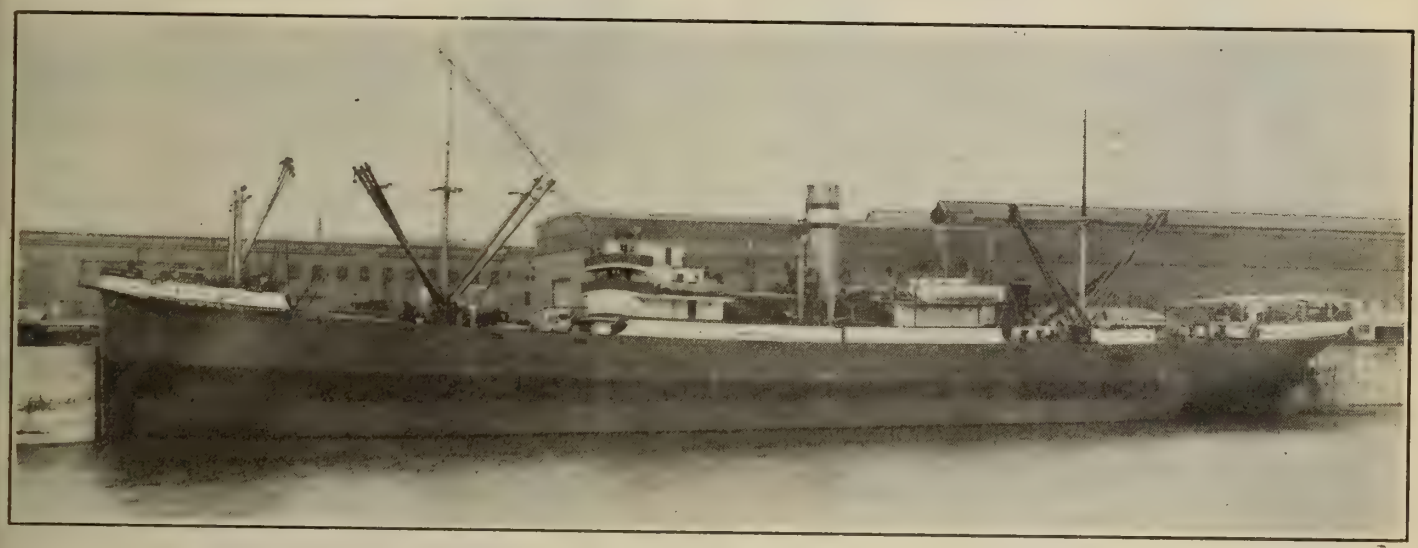

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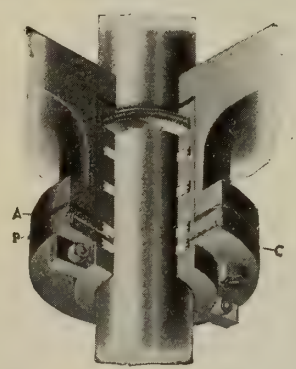

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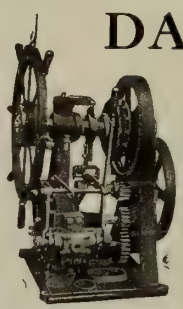

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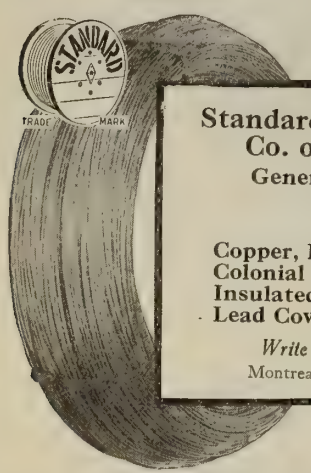

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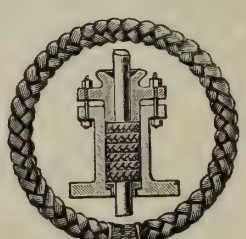

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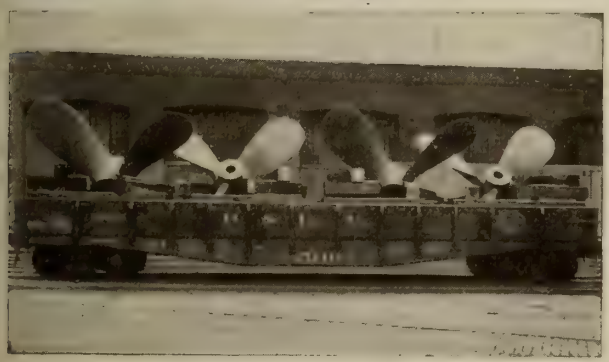

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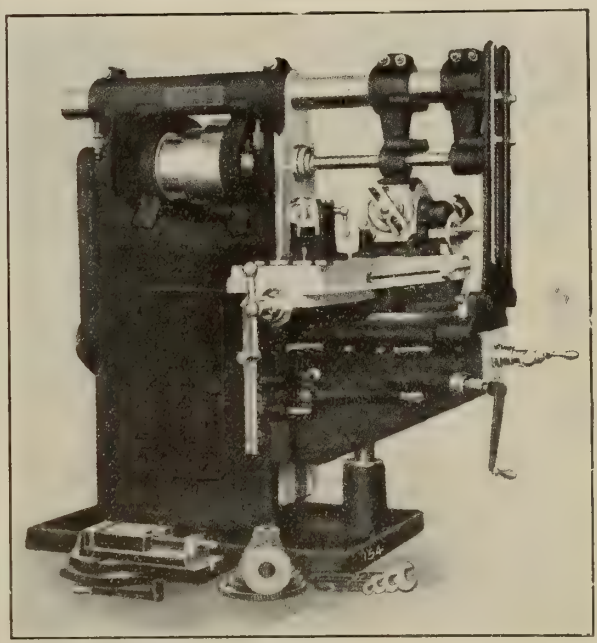

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Can. Vickers, Ltd., Montreal, Que.
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Goldie & McCulloch, Ltd., Galt, Ont.
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Crane Ltd., Montreal.
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Beatty & Sons, Welland, Ont.
British Manufacturers Corporation, Vancouver, B.C.
Canadian Fairbanks-Morse Co., Montreal, Que.

BUCKETS, DUMP
British Manufacturers Corporation, Vancouver, B.C.
Canadian Fairbanks-Morse Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.

BUCKETS, COALING
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CASTINGS, ALLOY
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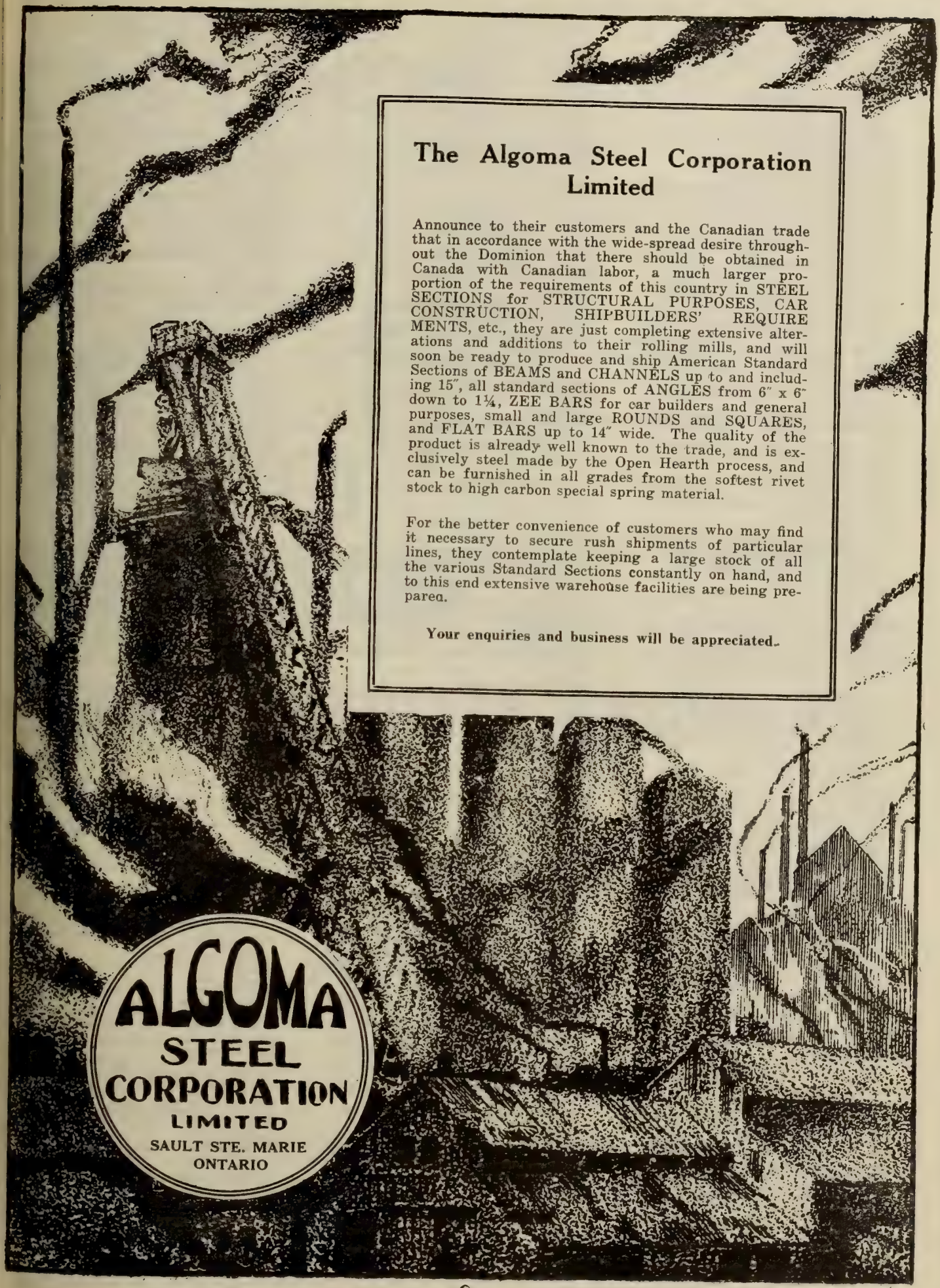
Smart-Turner Mach. Co., Hamilton, Ont.
Worthington Pump & Mach. Corp., New York City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DRILLS, HIGH SPEED
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Canadian Fairbanks-Morse Co., Montreal, Que.
Samuel Osborn (Canada) Ltd., Montreal.
Wilt Twist Drill Co., Walkerville, Ont.

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Butterfield & Co., Inc., Rock Island, Que.
Canadian Fairbanks-Morse Co., Montreal, Que.
Wilt Twist Drill Co., Walkerville, Ont.

DRILLS, RATCHET AND HAND
Butterfield & Co., Inc., Rock Island, Que.
Canadian Fairbanks-Morse Co., Montreal, Que.
Wilt Twist Drill Co., Walkerville, Ont.

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Wilt Twist Drill Co., Walkerville, Ont.

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Port Arthur Shipbuilding Co., Port Arthur, Ont.
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Goldie & McCulloch, Ltd., Galt, Ont.
Waterous Engine Works Co., Brantford, Ont.

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ELECTRIC ARC WELDERS
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ENAMELWARE
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ENGINEERS
New Burrell-Johnson, Yarmouth, N.S.

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Hopkins & Co., F. H., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont
Midland Engine Works Co., Midland, Ont.
Port Arthur Shipbuilding Co., Port Arthur, Ont

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Doxford & Sons, William, Sunderland, England

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Worthington Pump & Mach. Corp., New York City

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Can. Vickers, Ltd., Montreal, Que.
Doxford & Sons, William, Sunderland, England
Goldie & McCulloch, Ltd., Galt, Ont.
Hopkins & Co., F. H., Montreal, Que.
Mason Regulator & Engin. Co., Montreal Que.
Midland Engine Works Co., Midland, Ont.
Port Arthur Shipbuilding Co., Port Arthur, Ont
Trout Co., H. G., Buffalo, N.Y.
Waterous Engine Works Co., Brantford, Ont.

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Ministry of Munitions, London, Eng.
New Burrell-Johnson Iron Co., Yarmouth, N.S.

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Canadian Fairbanks-Morse Co., Montreal, Que
Scaife & Sons Co., Wm. B., Oakmont, Pa.

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Canadian Fairbanks-Morse Co., Montreal, Que
Corbet Fdry. & Machine Co., Owen Sound, Ont
Dake Engine Co., Grand Haven, Mich.
Kennedy & Sons, Wm., Owen Sound, Ont.

ENGINES, VERTICAL
Engbergs Elec. & Mech. Works, St. Joseph, Mich.

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Williams & Co., J. H., Brooklyn, N.Y.

FANS
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Row & Davis Engineers, Inc., New York, N.Y.

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Hopkins & Co., F. H., Montreal, Que.

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FIRE BRICKS
General Combustion Co. of Canada, Ltd., Montreal.
Mitchells, Ltd., Glasgow, Scotland.

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Row & Davis Engineers, Inc., New York, N.Y.

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MacKinnon Steel Co., Sherbrooke, Que.
Mason Regulator & Engin. Co., Montreal, Que.
Row & Davis Engineers, Inc., New York, N.Y.

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Adolphe Huot, Reg'd., Quebec, Que.
Crane Ltd., Montreal.
Hopkins & Co., F. H., Montreal, Que.
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FITTINGS, MOTOR BOAT
McAvity & Sons, Ltd., St. John, N.B.

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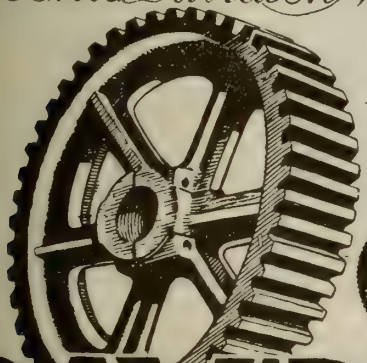

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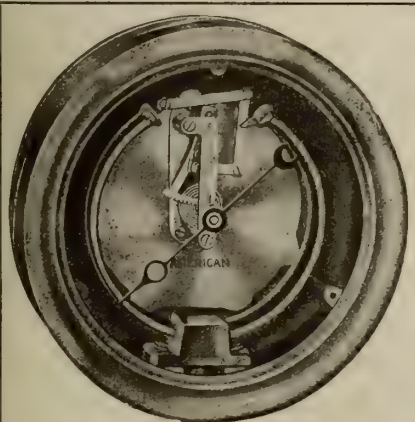

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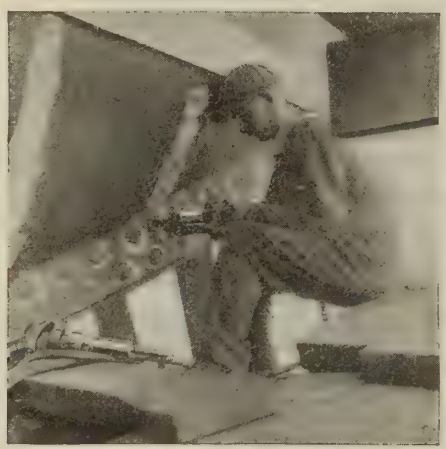

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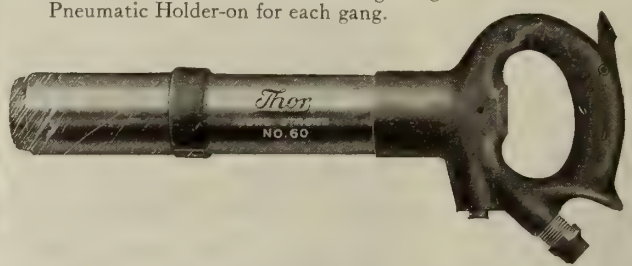

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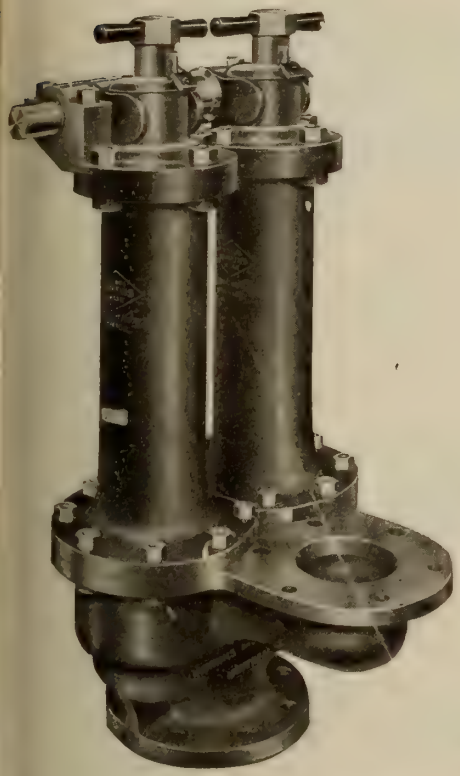

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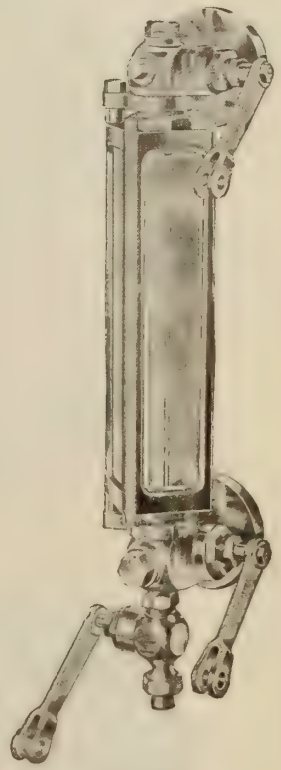

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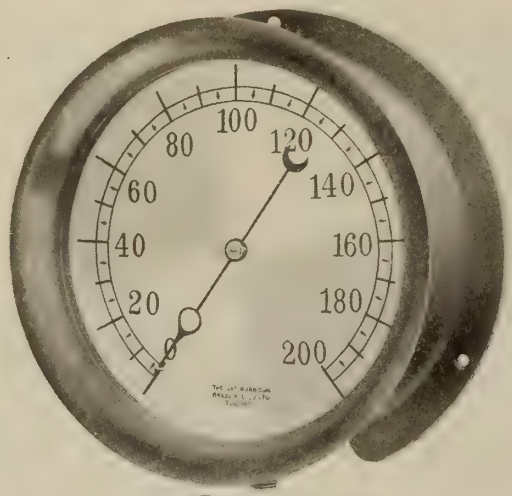

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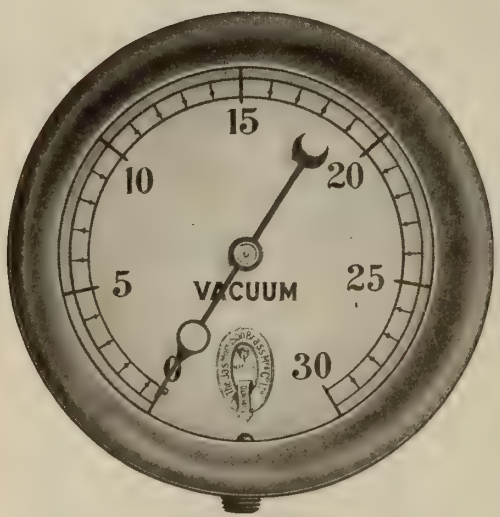

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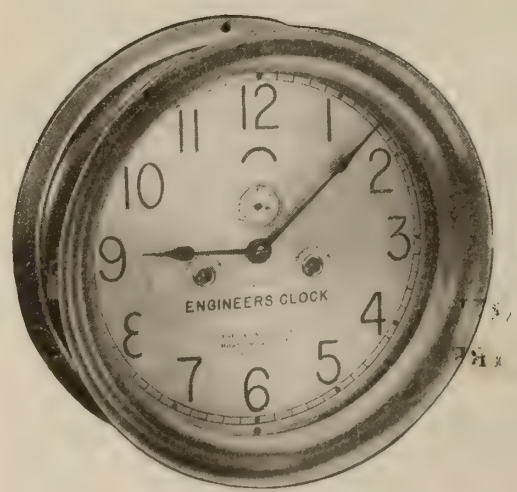

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and
Canadian Merchant Service Guild Review

VOL. X. PUBLICATION OFFICE TORONTO, MAY, 1920 No. 5

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PROPELLER WHEELS, IN ANY SIZE AND ANY MATERIAL

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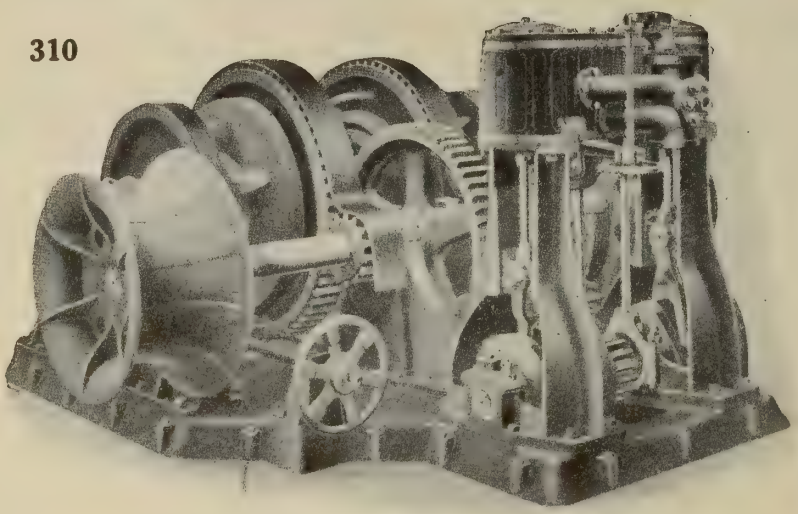

The "HYDE" Spur-Geared Steam Windlass;

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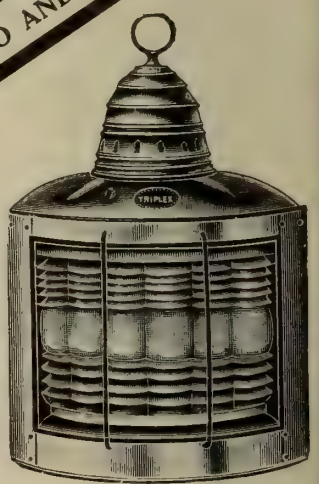

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OPPOSED PISTON TYPE
of Proved High Efficiency for Propulsion and Auxiliaries

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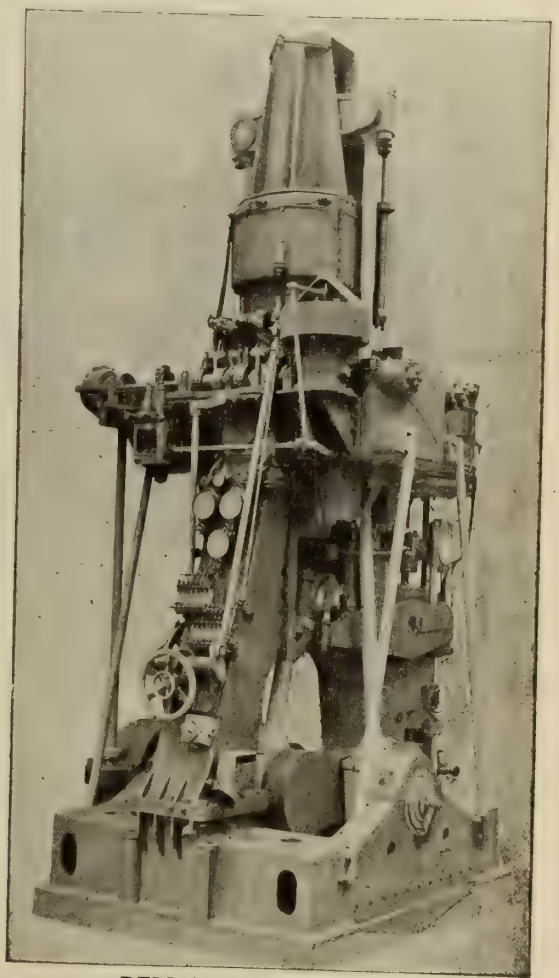

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Two-Stroke Marine Oil Engine
OPPOSED PISTON TYPE
SOLID INJECTION
Four-Cylinder Installations up to 4,000 I.H.P. on Single Shaft, 70 revs.

MARINE ENGINEERING AND MERCHANT SERVICE GUILD REVIEW, May, 1920. Vol. X., No. 5. Published at 143-153 University Ave., Toronto, Canada. Subscription price in Canada, $2.00; in the United States, $2.50. Entered as second-class matter July 1st, 1912, at the Post Office at Buffalo, under the Act of March 3rd, 1879, and at the Post Office Department, Ottawa, Canada.

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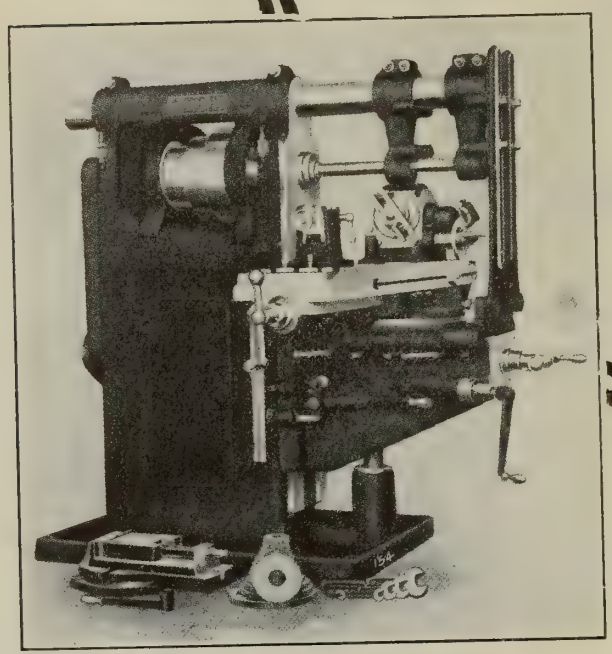
Machine Tools of Quality
Canadian Made



Ford-Smith Machine Tools comprise a large, thorough, efficient modern range of Milling Machines and Grinding equipment.

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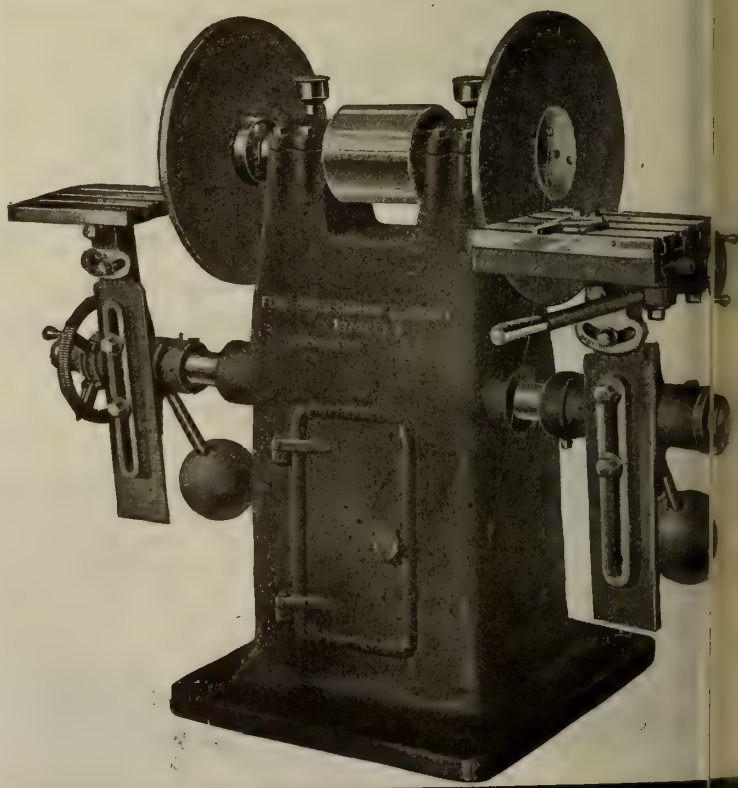

The **size of your output** and the **accuracy of the work** depends largely upon the tools being kept well and correctly ground. With a Ford-Smith grinder, the operator can keep his tools in the best shape with a minimum of time and trouble.

The Ford-Smith Machine Company, Limited

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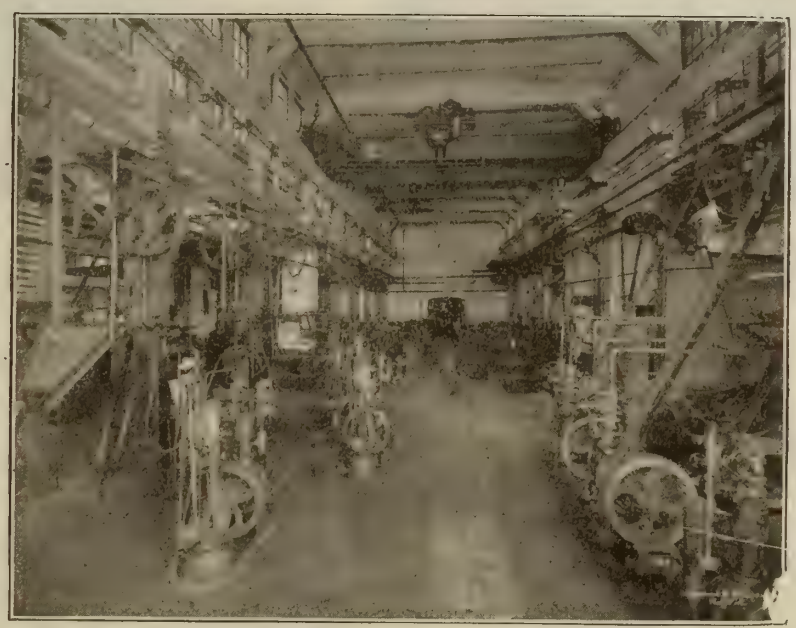
A TRIP THROUGH THE SHOPS WHERE BRUNSWICK ICE MACHINES ARE BUILT



TESTING: One reason why BRUNSWICK machines work. Every machine, before it is shipped, is run under its own steam and actually produces refrigeration with anhydrous ammonia. This insures a machine that not only appears correct, but one which we know will do the work for which it is designed.

"Exclusive manufacturers in United States of Hall CO_2 refrigerating machinery."

Brunswick Refrigerating Co.

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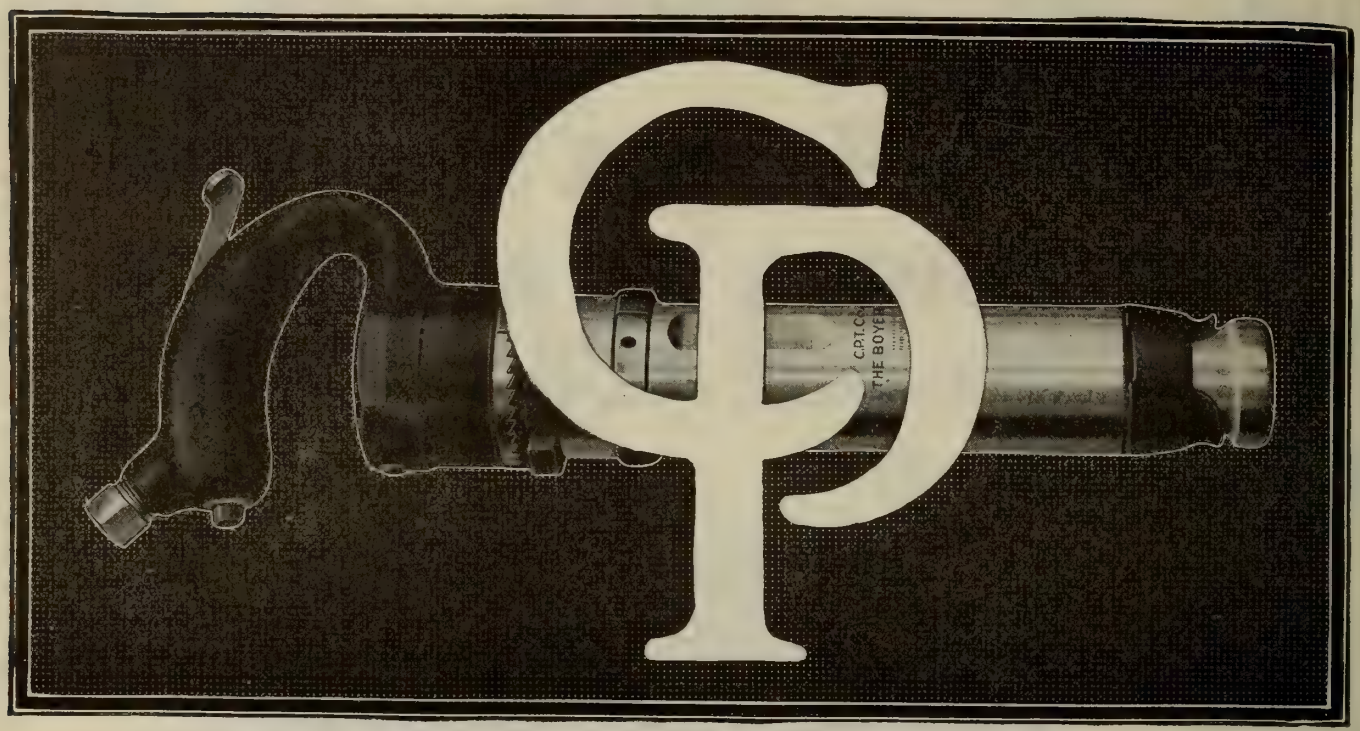

—but Boyer remains supreme!

NOT a riveting hammer made since the days when rivets were put down by "elbow grease" has approached the unequaled performance of the Boyer.

The veteran workman, of brawny physique and steady, vise-like grip, best appreciates the built-in sturdiness, well-balanced, powerful blow, and day-in-and-day-out dependability of the Boyer Pneumatic Hammer.

More and better work mark the trail of every Boyer-equipped workman, due to distinctive Boyer features.

Standardize with Boyers. Made for riveting, chipping, calking, scaling, flue-beading, etc. Stock delivery can be made from the Company branches listed below.

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Canadian Factory: Canadian Pneumatic Tool Company, Montreal

P-53-H

BOYER PNEUMATIC HAMMERS · LITTLE GIANT PNEUMATIC AND ELECTRIC TOOLS
CHICAGO PNEUMATIC AIR COMPRESSORS · VACUUM PUMPS · PNEUMATIC HOISTS,
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Dependable Power at *Less Cost Per Hour*

ANNOUNCING

DOMINION OXYGEN COMPANY, Ltd.

The Dominion Oxygen Company, Ltd., from its very inception takes high rank among the leaders of Canadian Industry.

Product

Foreseeing an extraordinarily rapid development of Canadian business, it plans a chain of modern plants for the production of atmospheric oxygen of high purity.

Five important industrial centers have already been chosen as locations for as many plants. The building program is actually under way and is being rapidly pushed to completion.

Cylinders

Dominion Oxygen Cylinders will be of the most modern type, designed to carry the maximum quantity of gas with the least possible weight, thus insuring the lowest shipping and handling expense.

Under the comprehensive selling plan of the Company, these cylinders will be loaned to the consumer on liberal terms.

Policy

Broad in its scope, the Dominion Oxygen Company, Ltd., is still broader in its policy. It has planned and is providing a great distributing system which, through a network of centrally located warehouses and distributing stations, will insure Canadian oxygen users of a never-failing and prompt supply of pure oxygen in any quantities.

This service will be extended in all its ramifications as rapidly as new plants are completed.

By inaugurating, with its patrons, a relationship of unusual breadth and liberality, the Dominion Oxygen Company, Ltd., will be a constructive force in promoting the tremendously increased use of the oxy-acetylene process.

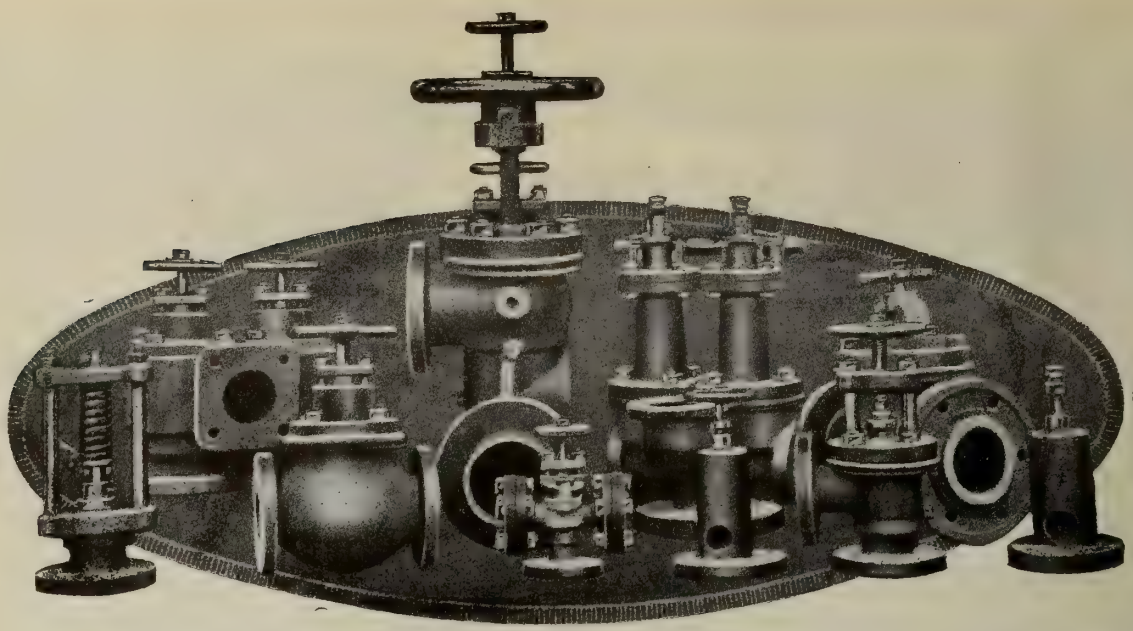
A Suggestion

It will be to the advantage of Canadian users of oxygen to write for more detailed information before contracting for their future oxygen requirements.

DOMINION OXYGEN COMPANY, Ltd.

265 Adelaide Street West

Toronto, Canada



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TO PASS Admiralty, War Office, Board of Trade, Lloyd's, British Corporation, Bureau Veritas, Dutch Government, American Passenger Act, etc.

Also SHIP'S SIDE VALVES, SUCTION AND DELIVERY VALVE BOXES, Etc. to pass any survey

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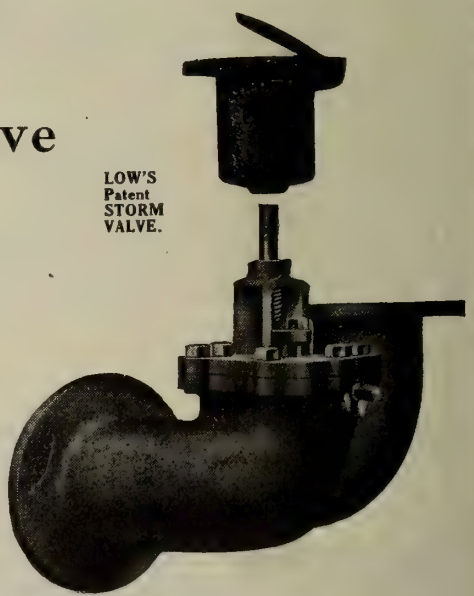
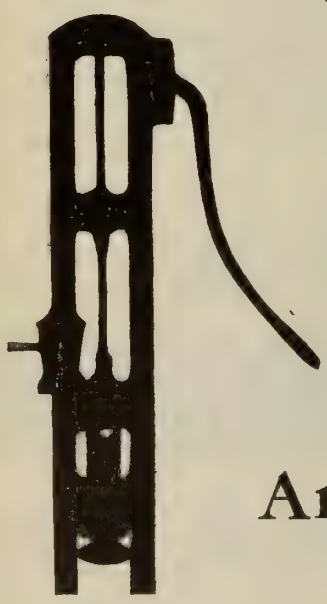
Low's Specialties *for* Ships

Low's Patent Screw-down Storm Valve

(Illustrated on Right)



LOW'S Patent STORM VALVE.



The chief advantages are: The small space it occupies—no separate Sluice or Storm Valve needed—Indicating deck plate shows whether valve is open or shut. Not affected by the ship rolling.

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(Illustrated on Left)

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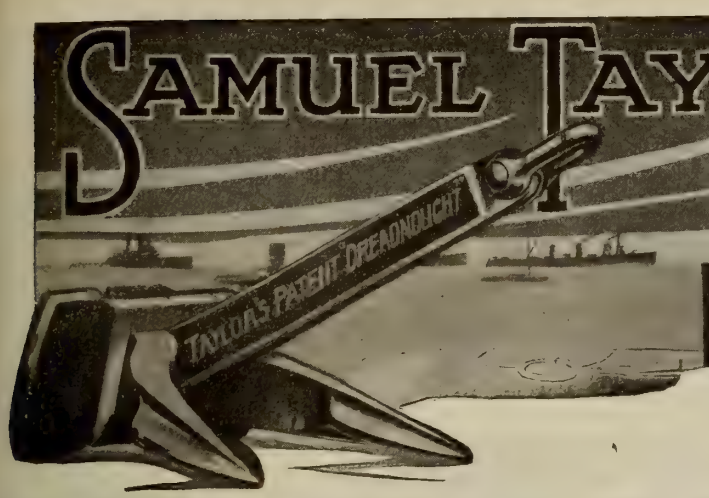

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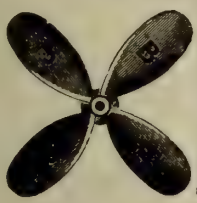

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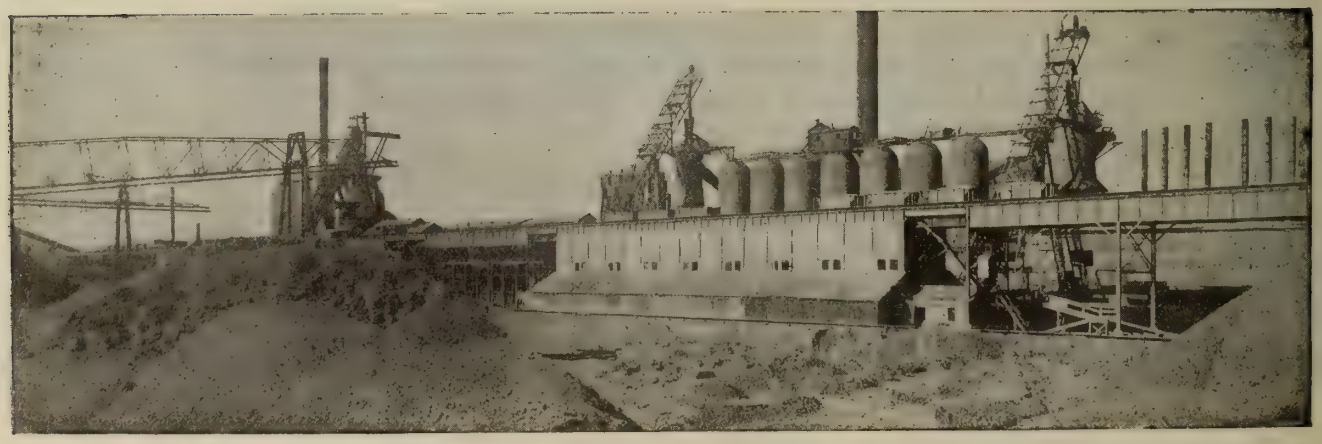

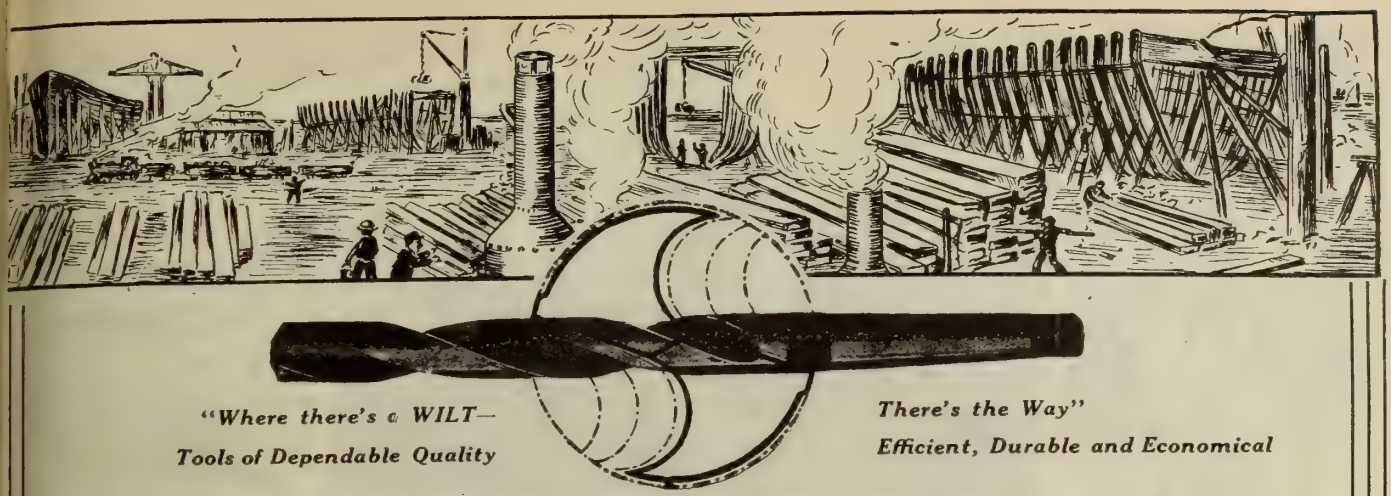

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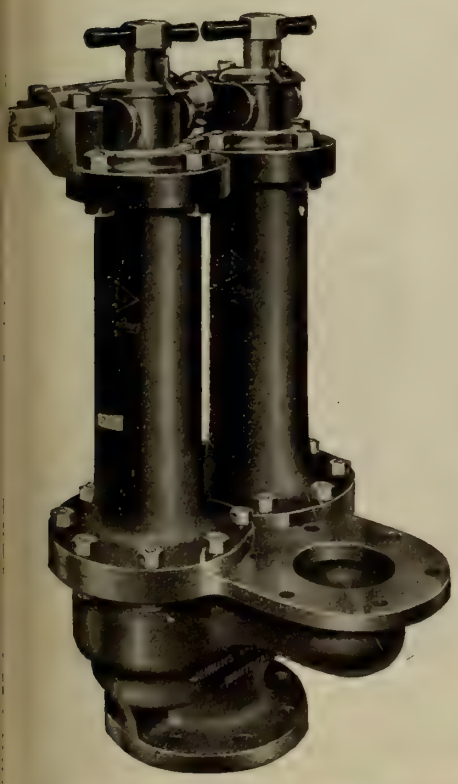

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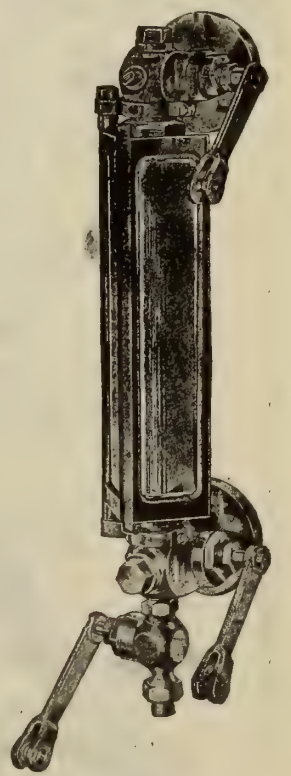

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Cleveland Riveting Hammers

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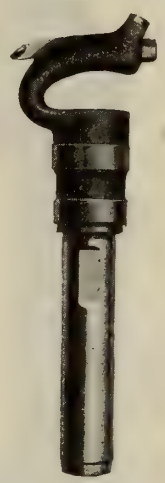

Cleveland Pocket-in-Head Riveting HAMMERS are shorter, weigh less, hit harder, run faster, use less air and have less recoil than any Riveter on the Market. The "Pocket"-in-Head is a "Reservoir" surrounding Main Valve and is filled with Compressed Air, which is discharged in Volume on Piston at each Stroke, greatly increasing speed and power of Blow. Ideal for "Piece-Workers" in Ship Building. Made in 5 sizes: Nos. 40, 50, 60, 80 and 90, with Outside and Inside Latch. Driving capacities from ⅜-in. to 1½-in. Rivets.

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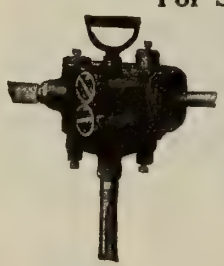

The No. 20-W, illustrated, is speedy and easily handled by one man. Made in 3 sizes—Nos. 10-W, 20-W, 30-W. Capacities, 1″ to 4″. The No. 20-TC, illustrated, is a lightweight compound geared machine; speeds 150 or 250 R. P. M. Capacity, 1¼ drilling in steel, ⅞″ reaming. An ideal one-man machine.

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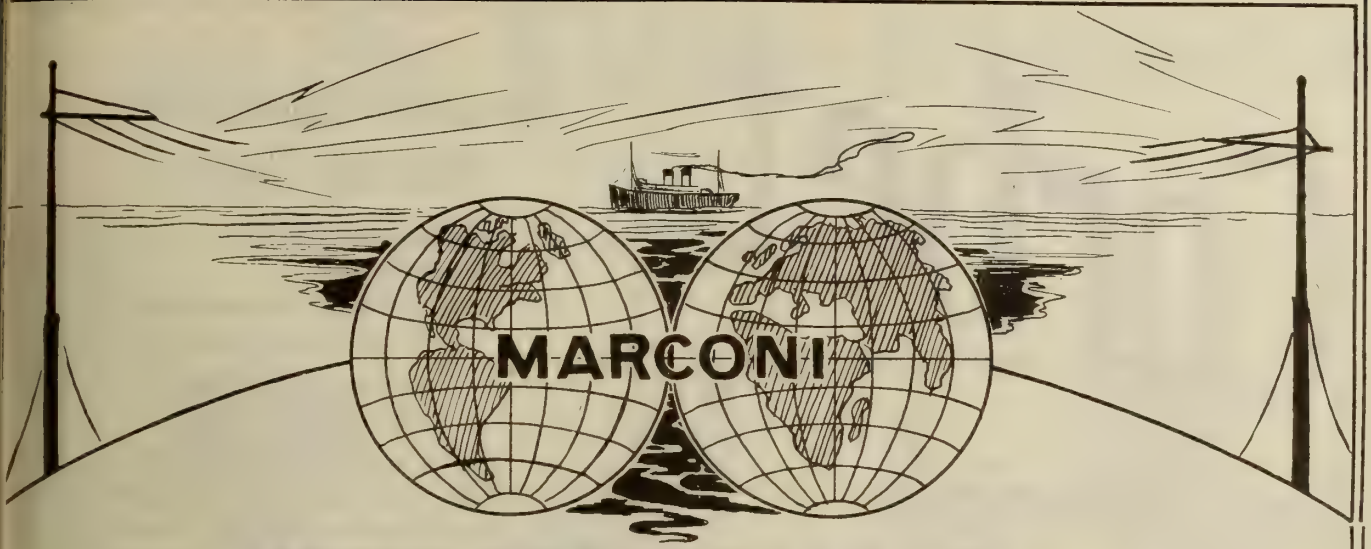

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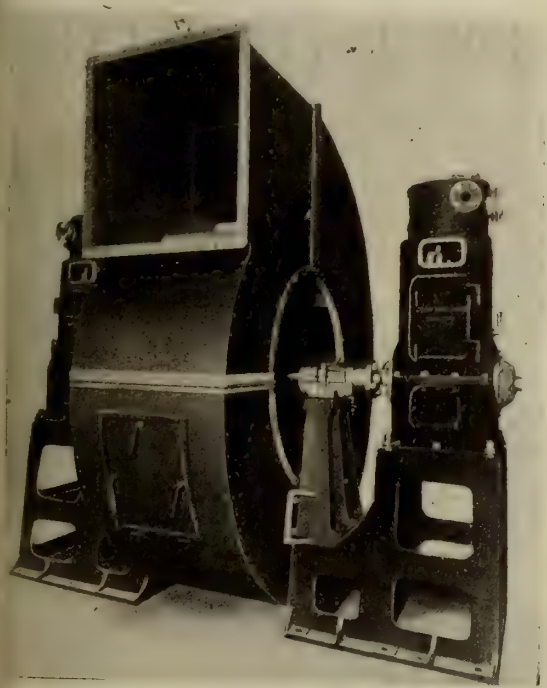

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Immediate shipment for repair work. *Write or Telegraph for Prices.*

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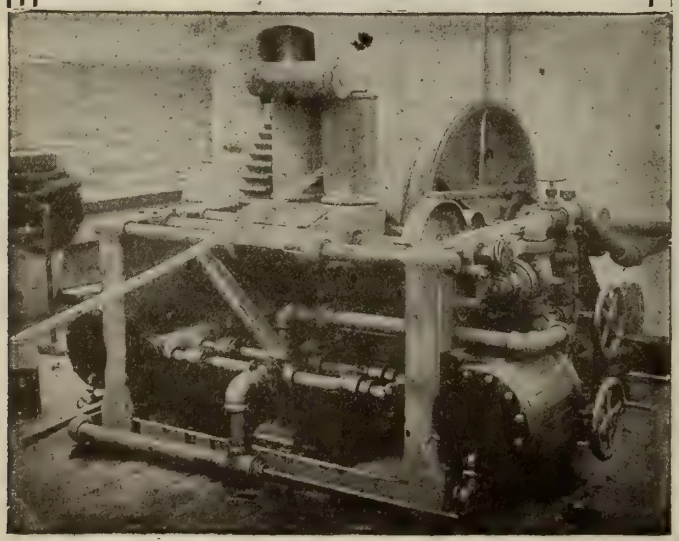
The
Corbet Foundry & Machine Co., Ltd.
Owen Sound - Canada



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is guaranteed to meet specifications of

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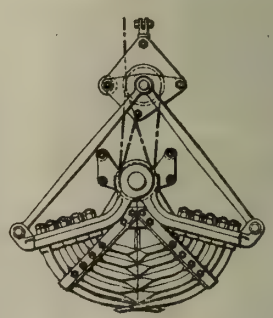

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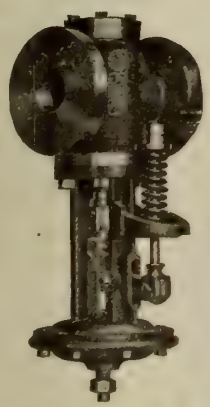
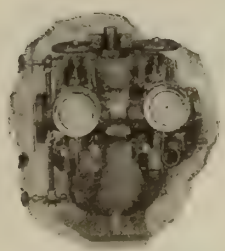
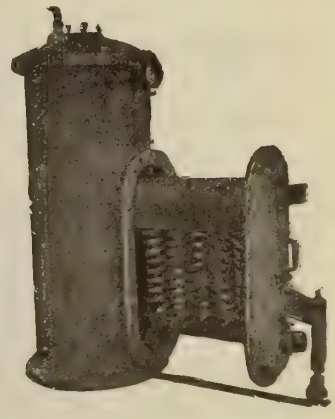


Mason No. 126 Style Marine Reducing Valve

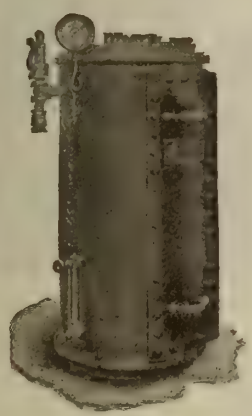


Reilly Multi Screen Feed Water Filter

Mason Standard Bronze Reducing Valve



Reilly Marine Evaporator, Submerged Type



Reilly Marine Feed Water Heater

Made in Canada

When you buy **Mason** Marine Specialties you buy Made-in-Canada products—but we don't ask you to buy **Mason** products for patriotic reasons; their quality should have a sufficient appeal.

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Length Overall 385 ft.

Breadth Moulded 52 ft.

Depth Moulded 28 ft. 9 in.

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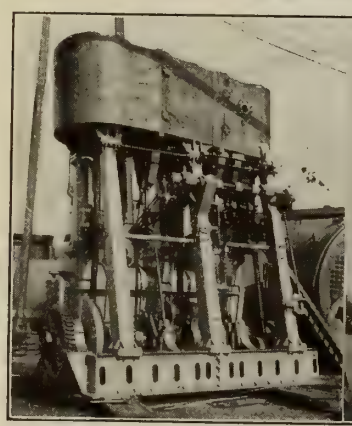

1500 H.P. Engine, Triple Expansion

Fourteen of these Trawlers for Dept. of Naval Service

Wheel Casting 14 ft. 9 in. diameter

The above are some of the products of our plant
We are also fully equipped with every modern facility for
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DRY DOCK 700′ x 93′ x 16′
Four Building Berths

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MARINE ENGINEERING
and
Canadian Merchant Service Guild Review

Vol. X. MAY, 1920 No. 5

Stabilizing Ships by Means of the Gyroscope

This Paper Was Read at the March 1920 Meeting of the Institution of Naval Architects, and Deals With a Very Important Phase of Marine Invention.

By P. R. JACKSON

THE problem of controlling the movements of vessels when under the influence of impulses received from the waves is one which has been dealt with at considerable length in the Transactions of this society. Previous papers have investigated very fully both the fundamental aspect of the subject, and various mechanical arrangement for stabilising vessels, so that the present paper will only describe some recent developments which demonstrates the practicability of theories previously discussed by the members of this institution.

In order that the method of operation of this system should be clearly understood, it is necessary that we should thoroughly appreciate and carry in our mind the manner in which a ship with ordinary stability, first commences to roll, and subsequently attains a state of heavy rolling.

The simplest wave system is a long ocean swell, such as is encountered in deep water after a gale, and the profile of such a system of waves probably very closely approached a sine curve. Such a profile is seen in the diagram, Fig. 1, where T represents the period or time of one complete cycle: above this wave profile is shown another curve whose ordinates represent "wave slope," and are constantly proportional to the wave impulses imparted to the ship. It follows that the impulses received by the ship vary in value in accordance with a sinuous curve, and that the maximum values of the roll-producing couple occur at T/4 and 3 T/4. In one period T the vessel is subjected first to a gradually increasing impulse from one side, and then after this impulse has died down to zero by a similar impulse from the opposite side, both impulses being produced by one wave. At the instant when the impulse changes from one direction to the opposite the crest of the wave is passing under the keel of the vessel.

Actual wave formation as met with in rough weather, however, do not conform to the profile shown, because the period T does not remain constant for any length of time, and the outline of the wave is nearer a trochoidal form than a sine curve. If the wave has a trochoidal form or something approaching that, the times at which the maximum inclining forces are received are not symmetrical throughout the wave period, but the sinuous character of the impulses still remains. In a confused sea rapid changes in phase of the waves occur, due to several wave systems being imposed on one another. Such a change in phase is shown in the diagram (dotted), profile shown in solid line is indicated by a corresponding solid line in the curve of roll-producing moments. To indicate the effect of change of phase we have also shown another wave profile (dotted) with its corresponding roll-producing moments dotted in the diagram above.

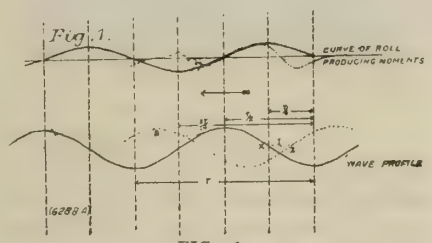


FIG. 1.

In order to obtain definite data an instrument, Fig. 2, was constructed to

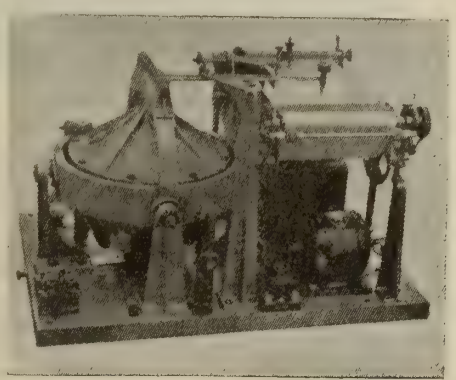


FIG. 2.

draw a curve of the actual oscillations of a vessel when rolling freely under wave impulses. If we examine one of these diagrams, Fig. 3, we see that the roll gradually increasing by comparatively small successive increments, then dies down again, and almost immediately commences to build up again.

These times of increasing roll represent the state of affairs when the period of the wave impulses approaches the natural period of oscillation of the ship, and is in phase with the ship's oscillations; when the impulses become markedly out of phase with the ship's roll the amplitude is reduced. Sometimes a sudden reversal is seen which is caused by the vessel meeting a new wave system entirely out of phase with her own period, so that when rolling, say, to starboard with considerable velocity she receives a wave impulse driving her to port. Under such circumstances the angular momentum of the vessel has to be dissipated, and momentum acquired in the opposite direction.

About 25 years ago Sir John I. Thornycroft stated before this institute that in his opinion ships could be prevented from rolling by means of forces which would neutralise the wave impulses, as distinct from attempts to destroy or reduce the rolling motion of the ship after it had obtained angular momentum. In the system under consideration Mr. E. A. Sperry has worked along these lines and has produced a machine capable of opposing the roll-producing couples by a series of equal and opposite couples and with practically no lag between the roll-producing couple and the opposing stabilising couple. The magnitude of the forces which have to be impressed on the vessel are comparatively small, amounting only to the magnitude of the impulse received from a single wave as shown in the rolling diagrams. By thus preventing the roll from building up the vessel in maintained within 2 deg. of the vertical.

Fig. 4 illustrates the system in diagrammatic form. The main stablising gyro is shown with its spinning axis vertical, and so mounted that it can be precessed in the plane at right angles to the paper by means of the circular rack engaging with the pinion of the precession motor. The direction of spin, precession and resulting couple are shown by the arrows. At the side of the diagram appears a small gyroscope with its spinning axis horizontal. The gyro is so mounted that the slightest acceleration of the vessel in the rolling plane will cause it to precess and close an electrical contact, which, by means of suitable relay switches, oper-

Fig. 3. DESTROYER No 114.

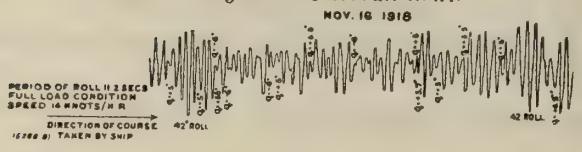
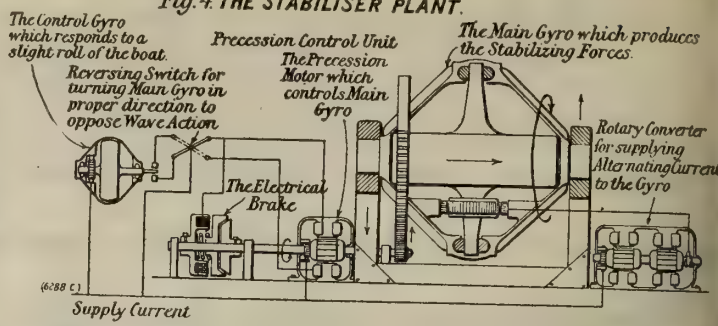


Fig. 4 THE STABILISER PLANT.


The Control Gyro which responds to a slight roll of the boat.
Precession Control Unit
The Precession Motor which controls Main Gyro
The Main Gyro which produces the Stabilizing Forces.
Reversing Switch for turning Main Gyro in proper direction to oppose Wave Action
Rotary Converter for supplying Alternating Current to the Gyro
The Electrical Brake
Supply Current

ates the main precession motor, and thus causes a stabilizing couples to be applied to the vessel just sufficient to neutralize this impulse which was causing the angular acceleration in the rolling plane. Immediately this acceleration ceases the control gyro stops the precession motor and is ready to deal with the next wave impulse.

It is obvious that all gyroscopes sufficiently large to effectively stabilize a vessel must have considerable gyroscopical inertia. It is for this reason that the method of control is so important, as by its great sensitiveness it enables the wave impulses to be dealt with before the vessel has attained any considerable angular momentum, the precession motor overcoming the gyroscopical inertia and so keeping the stabilizing couples in phase with the wave impulses.

The stabilising gyro system may consist of one or two gyroscopes according to the power required. If one gyro only is used it is placed with its spinning axis vertical, and mounted so that it can precess in the fore and aft plane of the vessel. If two gyros are employed their spinning axes are placed horizontal, but the direction of spin of one gyro is opposite to that of the other. The precession plane is also horizontal, but the gyros are precessed in opposite directions, so that the stabilising couples act in the same direction.

The stabilising gyros are designed to apply a roll-quenching couple sufficient to suppress the greatest single increment of roll that the waves would produce under conditions of free rolling. This couple must be proportional to D H sin α, and be applied throughout the ship's natural period, where α = effective wave slope. Consequently the capacity of the stabilising equipment must be proportional to D.T.H., where

D = displacement of vessel,
T = period of one complete oscillation.
H = metacentric height, or G.M.

As we have seen, the couple produced by the wave changes in value according to a sinuous curve, and attains its maximum values at times (about) T4 and 3 T/4; the gyro control system is consequently arranged so that the stabilising gyro will exert the maximum value of its roll-quenching couple at the same instant. The precession velocity of the gyroscope is in practice, made about 10 per cent. greater than the rolling velocity of the ship, and the maximum precession angle of the gyro is fixed at from 60 deg. to 70 deg. each side of the centre position. When stabilising a vessel against wave impulses which are just equal to its capacity the stabilising gyro makes one complete movement in the procession plane from, say, 60 deg. one side of the central position to 60 deg. on the other side in 9/10 of the vessels natural half period, although the vessel will not move more than 2 deg. from the vertical.

This is what occurs when the vessel is receiving successive wave impulses which are constantly trying to build up a roll. Now, suppose the vessel meets a new wave system of a different phase. Since the stabilising gyro is always under complete control, it will immediately adjust its procession so as to correspond with the new wave phase.

If the impulses received from the waves are less than the couple which the stabiliser can exert for a full precession, the control gyro automatically reduces the arc of precession, and as soon as any single impulse has been neutralised the precession is stopped. If an exceptionally large wave should encounter the ship and produce an increment of roll beyond the capacity of the stabiliser, the result will be an inclination of the vessel proportional to the excess of the wave couple over the gyro couple, but this inclination will be eliminated by the next precession of the gyro, as it is found in practice that these exceptional waves are only encountered singly, and are usually followed by waves of much smaller size.

The intensity of the stabilising couple is proportional to the velocity of precession, and since the rate and direction of precession are always completely under control and capable of almost instantaneous reversal, we have a source of energy by means of which we can either apply a regular sinuous couple in the exact rolling period of the vessel, or an irregular series of stabilising moments as may be required in order to counteract the roll-producing forces of the waves.

For example, in Fig. 1. if we imagine that the wave system B B suddenly appears in the original wave system, we would get a state of affairs as indicated. The two systems would, however, tend to merge one into the other approximately as shown. If a vessel was under the influence of the wave profile shown in the full line the direction of the progress of the wave being as indicated by the arrow, on reaching a point X the roll-producing moment would decrease very rapidly on account of the advancing B wave, until at Y the sign of the moment would be reversed, and the ship would then come under the direct fluence of the B wave.

If we now consider the moveme of the stabiliser under these circ stances, we see that when the ve reached the position X, the gyro wo be approaching the vertical position the precession are, where it would d ver its maximum roll-quenching cou Immediately the roll-producing mom decreased in value the rate of prec sion would be checked until the g would come to rest at about the sa instant as the vessel reached the p tion Y. The direction of precess would then be reversed, although gyro might only have precessed about 10 deg. past the vertical positi The vertical position of the gyro wo again be reached at about the posit Z, and the precession would then carried on at the ordinary rate to co teract the gradually decreasing mom produced by the B wave.

Having considered the principles which this system is based it will be teresting to examine the mechanical tails of some actual equipments. F a 10,000-ton steamer two cast-st wheels were used, each 9 ft. in diamet and each weighing about 25 tons. T steel casting must, of course, be curately machined all over and accura ly balanced, both statically and dyn mically, which is done by means balancing plugs. The rotor disc is pierced in the centre, but is attached its shaft stubs by means of collar stu One of the shaft stubs carries the rot of a three-phase A.C. motor for spi ning the wheel, the stator being attach to the gyro casing which is made four pieces, two forming an annul section surrounding the rim, and t conical end-pieces carrying the rot bearings. The peripheral speed of t wheels is about 500 ft. per second, a in order to reduce the driving pow the wheels run in a partial vacuum. is impossible to exceed the design speed because the speed of this type motor cannot be increased to any appr ciable extent above the designed lim The whole load is friction, so the a paratus cannot, under any circun stances, "race."

Fig. 5, showing the two stabilisin gyros being put on board the vessel ar the precession bearings on the top of t gyro casings, illustrates the relative si of the ship and stabiliser.

Fig. 6 shows a small installation in vacht of about 250 tons displacemen the control gyro being clearly show above the stabilising gyro.

The wonderful flexibility of the Sper- system is shown in the curves, Fig. which is an autographic record of e behaviour of a vessel fitted with a ıbiliser. First we see the roll when e vessel is allowed to oscillate freely, ıounting to 22 deg.; the stabiliser is t into operation, and almost at once e vessel settles down to an amplitude about 2 deg. As soon as the stabi- er is cut out up goes the roll again in one instance to 31 deg., which the ıbiliser promptly reduces to 3 deg. ıe total weight of equipment neces- ry for a normal type of vessel ıounts to only about 1 per cent. of the splacement.

By throwing over a switch the stabi- er can be made to roll the ship as own in Fig. 8. When a roll of about deg. has been obtained in still water e precession motor is stopped, and e natural frictional extinction curve the vessel is obtained. By again roll- g the vessel to 10 deg., and then re- rsing the precession motor and stabi- ing the vessel we see the vessel ought to rest in one complete period. By means of this test the actual roll- enching power of the equipment can obtained. This roll-quenching capa- y is the number of degrees of roll ıenched by the stabiliser per half riod minus the number of degrees

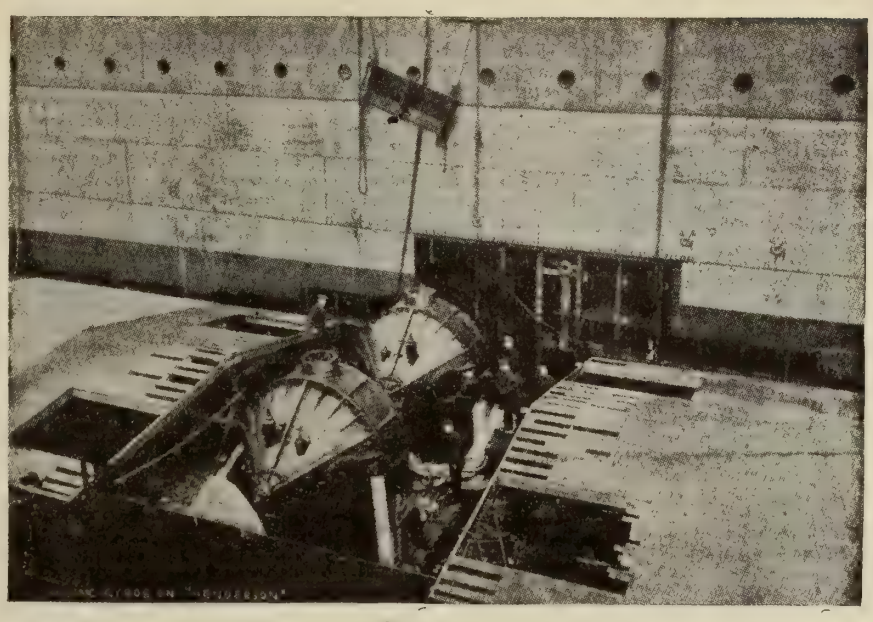


FIG. 5.

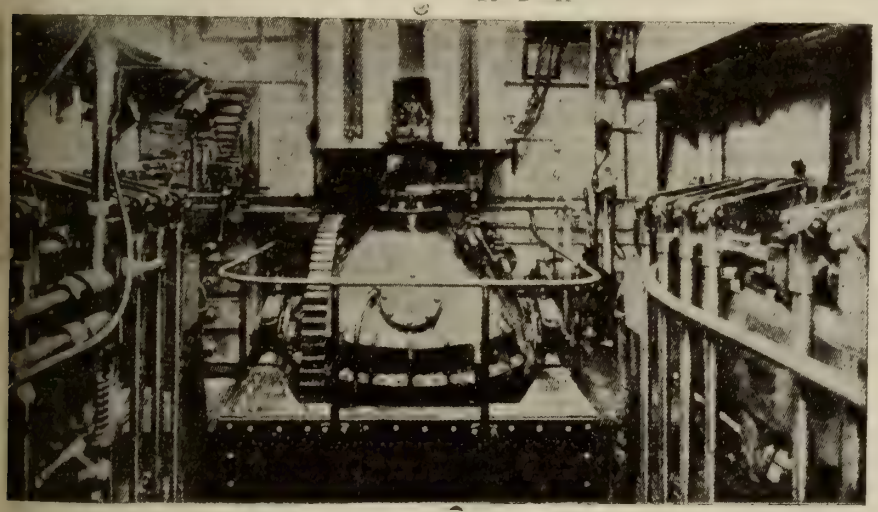


FIG. 6.

r half period shown on the natural tinction curve.

The advantages of stabilising a ship re many, and some of these advantages re obvious, but in actual practice it as been found that a stabilised ship haves in a manner which would sur- ise many people. It has been sug- sted that seas would break over the ssel; as a matter of fact exactly the verse is the case, the vessel becoming y and much more seaworthy simply cause she never has any angular velo- ty to be destroyed when meeting a ave, and consequently merely rises ıd falls on the waves as they pass un- r her. When stabilised a vessel will ake almost as good speed in rougher eather as in calm, and will steer with ry little helm because the yawing hich always accompanies rolling is en- rely eliminated. It is, of course, quite unnecessary to fit bilge keels to a stabilised vessel, with a consequent saving in power of as much as 6 per cent. of the total propulsive power of the ship.

Tank experiments have shown that the bilge keel resistance of a vessel on an even keel amounts to about 4 per cent., and this is increased by at least another 2 per cent. under average conditions of trim, and when the vessel is pitching to even a slight extent. When a vessel rolls she disturbs a much larger cross-section of water than when she is steady, which produces a corresponding increase in the propulsive power necessary for a given effective speed. Conversely, when rolling is eliminated a considerable increase in the actual speed of the vessel is possible with a given propulsive horse-power. This increase in speed during heavy weather has been fully substantiated by actual trials at sea.

The primary object of stabilisation, however, is not the reduction of the necessary propulsive power for a given speed, but the elimination of rolling per se. Not even the most hardened seaman will admit that the rolling of a vessel is an advantage. The steadier a ship is the better she is, and in the case of passenger vessels, naval vessels, and those ships which carry live stock, the advantage of being able to maintain the vessel practically on an even keel under all conditions is enormous.

The great interest which has been exhibited in all attempts to eliminate rolling are sufficient evidence of the value of a steady ship, and the Sperry system has proved that it is entirely practical and successful in operation. Installations in actual use ranging from vessels of 150 tons displacement to 10,000 tons have demonstrated that this system is no longer in the category of an experiment but that with a very moderate weight of equipment a vessel may be maintained within 2 deg. of the vertical, the power necessary for operating the equipment being a mere fraction of the energy dissipated by the extra resistance caused by the free rolling of the ship under the action of the waves.

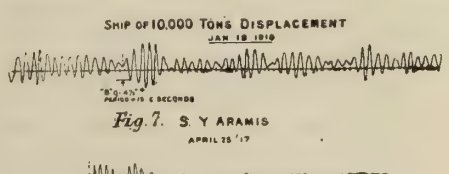


Fig. 7. S. Y ARAMIS
APRIL 25 '17

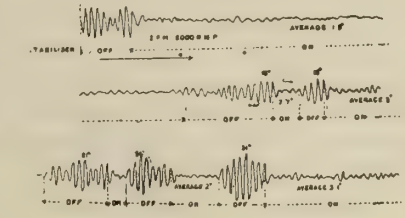
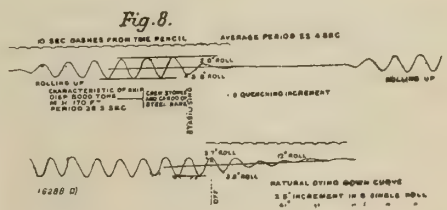


Fig. 8.



Lloyd's Register Shipbuilding Returns Quarter Ending March 31

A VERY interesting resume anent the world's output of shipbuilding for the quarter ended March 31, 1920, has been compiled by Lloyd's Register of Shipping, which is given below. It should be noted that warships are not included in these returns. Complete totals for Germany are not yet available; therefore no figures are shown for that country.

The merchant tonnage building in the United Kingdom at the end of March, 1920—viz., 3,394,425 tons—shows the large increase of 400,000 tons as compared with December, 1919, and is 1,140,000 tons more than the work in hand 12 months ago. The largest increase has taken place on the Clyde, where there are now 1,178,692 tons under construction.

The total "commenced" during the quarter amounts to 708,031 tons, and includes many large vessels. There are now building 210 vessel of 6,000 tons and upwards, as compared with 173 at the end of December. The vessels of 10,000 tons and upwards amount to 62.

The output during the quarter, however, shows a slight decrease as compared with that of the previous quarter. The total merchant tonnage building abroad—4,547,525 tons—is about 320,000 tons lower than the total building at the end of December; this is due to the large decrease in the tonnage building in the United States—393,000 tons less than at the end of December.

The figures for Italy are about 41,000 tons higher than at the end of December; they include the work in hand in the district of Trieste amounting to over 113,000 tons, In Holland there is an increase of about 38,000 tons, and in France of 23,000 tons.

The world's total of 7,941,950 tons is about 81,000 tons higher than the figures recorded for December. The tonnage of vessels actually building under the supevision of the Society's Surveyors, and intended to be classed with Lloyd's Register, amounts to 4,965,612 tons—viz., 2,648,-563 tons in the United Kingdom and 2,317,049 tons abroad.

The following figures showing the merchant tonnage building in the world six years ago—namely, at the end of March, 1914—may be of interest for comparison with the present totals: Building in the United Kingdom, 1,890,856 tons; building abroad, 1,452,298 tons; total for the world, 3,343,154 tons; of which 2,001,234 tons were building under the supervision of Lloyd's Register.

It will be noticed that, as compared with the present totals, the United Kingdom tonnage is over one and a-half million tons higher, the tonnage building abroad shows an increase of nearly 3,100,000 tons, and the tonnage under the supervision of Lloyd's Register has increased by nearly 150 per cent.

MERCHANT VESSELS UNDER CONSTRUCTION

The returns compiled by Lloyd's Register of Shipping, which only take into account vessels of 100 tons gross and upwards the construction of which has actually been commenced, show that there were 865 merchant vessels of 3,-394,425 tons gross under construction in the United Kingrdom at the close of the quarter ended March 31, 1920. The particulars of the vessels in question are as follows, similar details being given for the preceding quarter for the purpose of comparison:—

Description	Mar. 31,1920 No.	Mar. 31,1920 Gross Tons	Dec. 31, 1919 No.	Dec. 31, 1919 Gross Tons
Steam—				
Steel	814	3,379,731	722	2,980,938
Ferro-Concrete	7	1,401	5	1,700
Wood and Composite	4	1,799	7	2,502
Total	825	3,382,931	734	2,985,140
Sail—				
Steel	35	8,451	14	3,388
Ferro-Concrete	4	2,854	8	5,571
Wood and Composite	1	189	1	150
Total	40	11,494	23	9,109
Total Steam and Sail	865	3,394,425	757	2,994,249

The tonnage now under construction in the United Kingdom is 400,000 tons more than that which was in hand at the end of last quarter, and about 1,140,000 tons more than the tonnage building 12 months ago.

Of the merchant vessels being built in the United Kingdom at the end of March, 671 of 2,648,563 tons are under the inspection of the Surveyors of Lloyd's Register with a view to classification by this Society.

OTHER DETAILS

The following details concerning the shipbuilding work of the United Kingdom during the past three months may be added:—

During Quarter ended Mar. 31, 1920	Steam No.	Steam Gross Tons	Sail No.	Sail Gross Tons
Vessels commenced	203	701,723	26	6,308
Vessels launched	123	451,236	8	3,058

MERCHANT VESSELS UNDER CONSTRUCTION IN THE WORLD

Where Building.	Steam No.	Steam Gross Tons	Sail No.	Sail Gross Tons
United Kingdom	825	3,382,931	40	11,494
*Other Countries	1,193	4,418,519	147	129,006
Total for the World	2,018	7,801,450	187	140,500

*Excluding Germany, figures for which country are not yet available.

WORK IN HAND IN PRINCIPAL DISTRICTS

The following table gives the total figures for vessels now under construction in some of the principal shipbuilding districts of the country, as compared with those of the last quarter. Eac hdistrict, of course, includes places in the neighborhood of the port after which it is named.

District.	Description	Mar. 31, 1920. No.	Mar. 31, 1920. Gross Tonnage	Dec. 31, 1919. No.	Dec. 31, 1919. Gross Tonnage
Barrow, Maryport and Workington	Steam	14	118,990	10	84,675
	Sail	..	.....	..	.....
	Total	14	118,900	10	84,675
Belfast and Londonderry	Steam	42	357,250	39	336,700
	Sail	4	2,000	..	.....
	Total	46	359,250	39	336,700
Clyde — Glasgow	Steam	172	805,171	148	681,654
	Sail	27	5,851	7	2,260
Clyde	Total	199	811,022	155	683,914
Clyde — Greenock	Steam	74	367,670	66	336,505
	Sail	..	.....	2	1,400
	Total	74	367,670	68	337,905
Hartlepool	Steam	19	89,140	20	90,100
	Sail	..	.....	..	.....
	Total	19	89,140	20	90,100
Hull	Steam	58	78,168	67	62,571
	Sail	..	.....	1	162
	Total	58	78,168	68	62,733
Liverpool	Steam	45	106,125	35	76,380
	Sail	2	1,494	..	.....
	Total	47	107,619	35	76,380
Middlesbro' and Stockton and Whitby	Steam	47	216,430	49	224,560
	Sail	2	1,360	2	1,360
	Total	49	217,790	51	225,920
Newcastle	Steam	122	629,408	114	593,189
	Sail	..	.....	..	.....
	Total	122	629,408	114	593,189
Sunderland	Steam	75	346,215	65	299,465
	Sail	..	.....	..	.....
	Total	75	346,215	65	299,465

SIZE OF VESSELS UNDER CONSTRUCTION

The following table shows the vessels under construction in the United Kingdom classified according to gross tonnage:—

Gross Tonnage.	Number Steam	Sail
*100 and under 500 tons	160	29
500 " 1,000 tons	71	11
1,000 " 2,000 tons	90	..
2,000 " 3,000 tons	74	..
3,000 " 4,000 tons	71	..
4,000 " 5,000 tons	50	..
5,000 " 6,000 tons	99	..
6,000 " 8,000 tons	97	..
8,000 " 10,000 tons	51	..
10,000 " 12,000 tons	10	..
12,000 " 15,000 tons	29	..
15,000 " 20,000 tons	20	..
20,000 " 25,000 tons	3	..
25,000 " 30,000 tons	..	..
30,000 " 40,000 tons	..	..
40,000 tons and above	..	..
Total	825	40

*Vessels of less than 100 tons are not included in Lloyd's Register Shipbuilding Returns.

MERCHANT VESSELS UNDER CONSTRUCTION ABROAD

	Steamers and Motor Vessels. Steel No.	Steel Gross Tons	Wood No.	Wood Gross Tons	Sailing Vessels Steel No.	Steel Gross Tons	Wood No.	Wood Gross Tons	Total No.	Total Gross Tons
America—										
United States—										
Atlantic Cst..	270	1,525,827	7	5,300	9	3,700	10	7,340	535	2,573,298
Gulf Ports ..	38	180,793	9	22,600	1	5,000	4	4,800		
Pacific Coast	82	478,163	13	28,000	..	....	32	78,400		
Great Lakes.	60	173,375	..	.....	..	....	..	.....		
British Dominions—										
Canada—										
Great Lakes.	17	41,318	..	....	..	....	..	.....		
Coast	33	115,970	9	6,150	..	....	18	6,185	109	231,259
Other Domins.	22,	56662	6	4,220	..	....	4	1,754		
Belgium	7	25,640	..	....	..	....	..	....	7	25,640
Brazil	1	2,170	2	3,196	..	....	..	....	3	5,366
China	10	35,325	..	....	..	....	..	....	10	35325
Denmark	59	113,801	3	1,050	..	....	..	....	62	114,851
France	55	237,712	5	1,250	..	....	5	1,263	65	240,225
Greece	1	900	1	600	..	....	..	....	2	1,509
Holland	140	366,257	..	....	1	324	..	....	141	366,581
Italy(in. Trieste)	66	316,495	52	25,246	5	1,150	42	12,350	165	355,241
Japan	68	285,676	..	....	..	....	..	....	68	285,676
Norway	54	86,848	12	3,101	..	....	1	500	67	90,449
Portugal	..	.....	1	840	..	....	8	4,370	9	5,210
Spain	23	98,201	..	....	..	....	1	150	24	98,351
Sweden	56	112,905	11	3,928	..	....	6	1,720	73	118,553
Total....	1062	†4,313,038	131	105,481	16	‡10,174	131	118,832	1,340	4,547,525

* The figures for this country are not yet available.
† Including 16 berro-concrete vessels of 34,908 tons.
‡ Including three ferro-concrete vessels of 450 tons.

The tonnage being built in the world at the end of March under the inspection of the Surveyors of Lloyd's Register, excluding vessels the construction of which has not actually been commenced and excluding all vessels of less than 100 tons, amounts to 4,965,612 tons.

SHEFFIELD WIRE ROPE

Sheffield is justly proud of its wire ropes, for it makes the steel as well as the ropes, and Sheffield steel being the best it naturally follows that Sheffield ropes are the best, whether for ships' rigging or for mining haulage purposes. Wire ropes were first made in Sheffield in 1860. First there was a considerable demand for these ropes from colliery companies, then from the big works in the district, and next from the shipping fraternity. Besides the local demand for colliery haulage ropes, for ropes for the heavy steel and engineering works, and for shipping, there was very soon a big trade in wire ropes for various foreign countries and the colonies, especially for the gold mines. But the biggest demand has been, of course, on shipping account. Both naval and mercantile ships very speedily became users of wire ropes, and Shiffield has done a big trade in this line for two generations. All classes of wire ropes are made in Sheffield. The original works have been greatly extended, and fresh works, established in 1887 and in 1910. These have, in turn, also been extended quite recently. More than 6,000 tons of wire ropes are now turned out annually. There are dozens of different qualities or classes and gauges. There are ropes for rigging, for lifting, for haulage, for aerial or overhead railways, flexible ropes for drums and pulleys, and ponderous ropes for mining equipment, each and every kind made from some special steel to suit the purpose. The wire these various ropes are made from is all of high strain quality—80 to 120 tons per square inch —and the greatest care is taken in the processes of manufacture to produce the necessary uniform hardness, toughness and flexibility, according to the work for which the ropes are designed.. To avoid brittleness and to withstand the abrasion on pulleys, for instance, special steel is produced, and both the wire and the ropes are put through special processes. Everything in this group of products, from ropes weighing many tons to the finest wire for pianos, is made in Sheffield, from Sheffield steels, and by workmen who are artists in their line. Only a few months ago Sheffield sent out a rope five miles long, and 21 tons in weight, whilst much longer, but not heavier, ropes have been made from time to time. At the present moment a machine is being completed in the city which will spin and carry ropes up to 30 tons in weight. Every imaginable requirement of the navy, the mercantile marine, and of mining is being anticipated by Sheffield wire rope makers. There are three big wire rope-making plants in the city. The Sheffield Wire Rope Company, Ltd., is established at Darnell, within the city boundary, and produces every kind of rope required for shipping, mining, crane and engineering purposes. Messrs. John Shaw, Ltd., of the Yorkshire Wire Rope Works, Sheffield, supply the same classes, and besides having a big British shipping connection they make a special point of colonial requirements, and have branches in Melbourne, Adelaide, Perth, Kalgoorlie, Auckland, Johannesburg, and Bulawayo Messrs. Wm. Cooke & Co., Ltd., of the Tinsley Wire Rope Works, Sheffield, particularly specialize in the heavy varieties of rope, and do a big and growing trade in shipping, trawling, engineering and mining ropes.—"Syren and Shipping."

The circumstances of an explosion which occurred on the steamship Willaston were rather unusual. Parts of two combustion chambers of the port boiler, in the vicinity of the auxiliary feed inlet, appear to have become overheated, and, in consequence, two stay nuts holding a portion of the side of the starboard combustion chamber, became unable to support the heated and weakened plate, which was forced over the ends of the stays. There is no suggestion that the boiler was short of water when the explosion occurred in the starboard combustion chamber, and the overheating appears to have been due to a non-conducting layer of oil which was deposited locally on the plates by the feed-water. The collapse of the port wing furnace was, according to the observations of the Engineer Surveyor in Chief to the Board of Trade, probably due to overheating resulting from shortage of water subsequent to the explosion in the starboard combustion chamber.

The shipments of iron ore from Canadian mines in 1919 were the lowest that have been recorded within nineteen years and amounted to a total of 195,970 tons as compared with 211,608 tons in 1918. The total production of pig iron in Canada in 1919, excluding the production of ferro-alloys, was 917,346 short tons (of 2,000 lbs.), as compared with a total production of 1,195,551 short tons in 1918.

The General Survey of Engines and Boilers

This Article Deals in a Descriptive Manner With the Work Necessary to Put a Ship's Engine Through Lloyd's or Board of Trade Survey

By T. H. FENNER

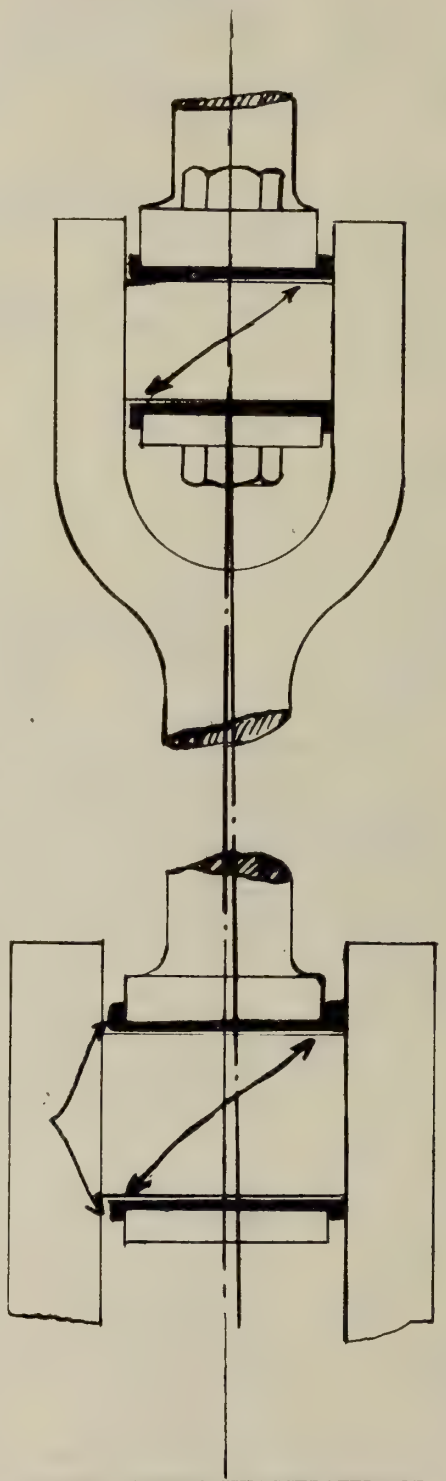
IN the preceding article we spoke of the methods of overhauling and adjusting the crosshead bearing of the connecting rod. In this article we will deal with the method of lining up the connecting rod so that its entire line is in line with the centre line of the cylinder.

When a ship is under weigh, the whole of the propeller thrust is received by the collars of the thrust block, and the surface of these tends to wear away. The extent of this wear will naturally be dependent on the hardness of the metal and the excellence or otherwise of the lubrication between the thrust block shoe, and the thrust collar on the shaft. The effect of this wear is of course to allow the whole shaft to work forward in an extreme case would eventually result in the thrust being taken by the main bearing brasses and the fillets on the crank webs. This, of course, would not last long, and would soon announce itself by a rapid heating of the bearing.

The forward movement of the crank shaft has the effect of throwing the connecting rod out of line. That is, instead of the centre line of the connecting rod being in direct alignment with the centre line of the cylinder, it becomes angled to it. This causes the crank pin brasses and the crosshead brasses to wear out of line. This effect is shown plainly by the accompanying sketches. In overhauling the rod, this must be counteracted and the brasses made parallel. First of all it is necessary to find out if the condition exists, and to what extent. The thrust shoes should set up to the collars on the shaft, so that the shaft will not move forward when the engine starts.

Incidentally, the shaft will be very close to its normal position when engines are stopped, for two reasons. If the last order before stopping was a go ahead order, the ship will have moved somewhat after the engines had steam shut off. This would pull the shaft back against the astern faces of the thrust shoes. As there is practically no wear on these faces, this would leave the shaft normal. If the last order was an astern one, it will in all probability have been with the object of taking weight off the ship, and the same effect will have occurred. The position of the shaft can, of course, be verified by gauging with calipers or a shut metal gauge between the crank web and the side of the main bearing housing where it is machined. The distance should be equal on each side.

Having ascertained that the crank shaft is in its normal position, and the thrust shoes adjusted to keep it there, we can start to test the rod. It is just as well to do this at both ends and in fact if the rod is found to be out it will have to be adjusted at both top and bottom. As we have been dealing with the crosshead, we shall proceed to try this first.



SHOWING EFFECT (EXAGGERATED) OF WEAR ON THRUST SHOES

The crank pin brasses must be slacked back sufficiently to leave them easy on the pin. The crosshead brasses are put together with the liners or distance pieces left out, so that the brasses will grip the pin when tightened up. The crosshead brass is then placed centrally in the crosshead so that there is the same clearance each side and wedged there with fox wedges or wooden wedges, just tapped in enough the prevent the brass from sliding. The nuts are then tightened up till the top and bottom brasses are tightly gripping the pin. Attention is now directed to the crank pin brasses. If the top end brasses are true, the crank pin brasses will be found to be lying dead central between the webs of the crank. If the crosshead brasses have worn tapered, the crank pin brass will be lying over towards the forward crank web. Owing to the length of the rod, and the very small width of the crosshead brasses, or if preferred, the short length of the crosshead pin, it requires but little wear out of the parallel on the brasses to throw the crank pin brass forward a considerable amount. The wear on the crosshead brasses will take place on the after end of the top brass, and the forward end of the bottom brass. The way to correct it, of course, is by filing the brass from the opposite end to which the wearing has taken place, the amount necessary being determined according to the length of rod and amount of wear. The amount may be so small as to require only a scraper, or it may need an appreciable amount taken off at one end to nothing at the other.

Suppose that when the crosshead is tightened up the crank pin brasses are found to be hard up against the forward crank web. This shows at once that the top end brasses have worn tapered, and must be squared up. Now it would be easy to caliper the thickness of the brass at each end were it not for the flange, which prevents the use of calipers. If there is a surface gauge and a plate available, the amount of difference can be easily found by that means. If there is no surface gauge, or plate, the brass can be laid on one of the main bearing cups, or even on its own cup, and a straightedge laid acorss the crown of the brass. The height from the edge of the straightedge to the face of the cup at each side can then be measured and the brass filed accordingly. This of course applies to both the top and bottom half of the brass. When both brasses have been filed approximately square, place them together with the liners in between just as they would be on the pin, and caliper them to see if they are parallel to each other. If not, correct them, and if found O.K. then put them into place again on the pin, and tighten up again. The crank pin brasses

should then be central on the crank pin. If not, then it may be necessary to take a little more off the top end brasses, but if the rod comes pretty close to central do not do any more work on the top end.

Proceed to do the same job with the crank pin brasses. That is, the liners are taken out, and the rod centred on the crank pin, after which the bolts are tightened up. The crosshead brasses will then show whether the crankpin end is true or otherwise. The same methods are used to correct any wear that may be present.

While we have not mentioned any of the details of taking down the brasses, this was all explained in a previous article, and the various steps will be, of course, the same.

It may be said here that this is a job that very rarely requires doing, as the wear on the thrust shoes is comparatively slight if they are kept well lubricated. The necessity for it will usually be indicated by the rod lying over towards the forward web, and it will be noted when trying the bearing with the bar, that the rod moves to the after side with difficulty, but springs back to the forward side with a snap.

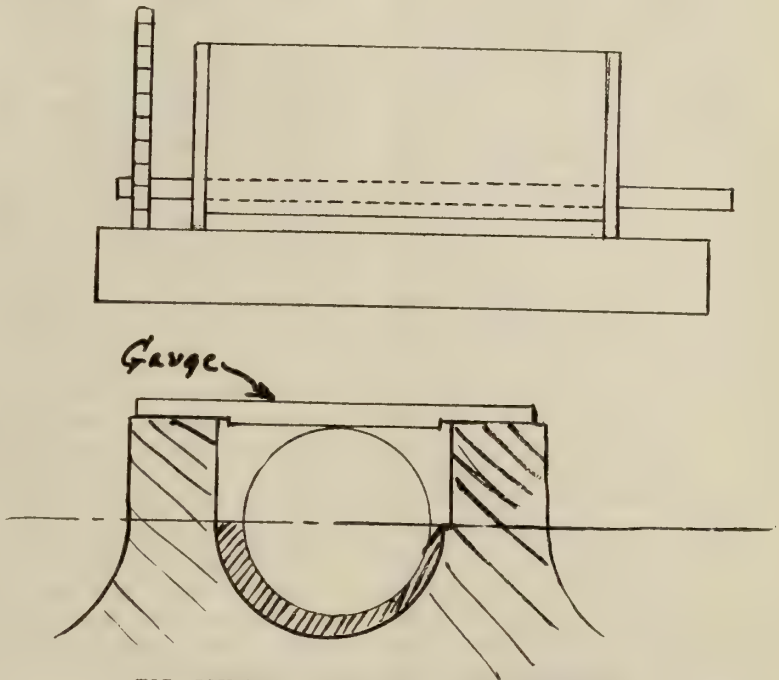
When this condition exists it is difficult to set the bearings up as they should be, and a considerable difference will be noted in the running of the engine after it has been corrected.

The explanations previously given and the present article cover the work to be done on the top and bottom end brasses, and we can now go on to some of the other work.

The Main Bearings.

The work to be done on main bearings is comparatively easy. It is a straight lifting job, taking off the cap and top brass. The same precautions must be observed before taking the nuts off as in the case of the connecting rod bearings. That is the position of the nuts must be marked so as they can be set back in the same position, or the amount advanced noted.

The bearing keep or cap is lifted after the nuts are taken off, by blocks hung from eyebolts screwed into the cylinder castings, tapped holes being provided for that purpose. After removal of the cap, the top half of the brass is lifted in the same manner, eyebolt holes being provided in the top of the brass. For the purpose of determining whether the shaft is down through wear of the bottom brass, a gauge is provided by the engine builders when the engines are erected, and this is carred on board. It is merely a flat piece of steel, with notches cut at each end to rest on the machined top of the main bearing housing. The edge of the gauge should just touch the top of the journal, and the gauge can be moved along the whole length of the bearing. Holding a light behind it will show if it is touching all the way along. The engines should be turned through a half revolution, thus allowing the whole of the journal surface to be examined. The surface should show a smooth brightly polished skin, and if there are any rough spots, which may occur if water has been used on the bearing, these should be smoothed up. The method employed to do this job, is by smooth filling, followed by rubbing up with an emery cloth, and finishing with an oil stone. It is not an easy job, but must be done thoroughly to obtain satisfaction.



TOP—SQUARING WITH TWO STRAIGHTEDGES.
LOWER—GAUGING MAIN BEARING JOURNALS.

If it is necessary to remove the lower half of the bearing it will have to be turned out of its place. The bottom brasses are usually made eccentric in shape, that is, one side is thinner than the other. This allows them to be started back, and turned round the shaft. Starting them is the hardest job, and it is best not to attempt to do this by driving. A good way to do it is to fasten a clamp on the crank web, with a projection that will press on the edge of the brass on the thin side, and then turn the engine slowly. The clamp will push the bearing out in front of it. It is not necessary to support the shaft when a bearing is taken out, as it will be plenty stiff enough to prevent binding. It is a very rare occurrence to have to remove these bottom halves, unless a bearing has been allowed to get hot enough to run the metal. Needless to say, this is not an event of any great frequency.

Main bearings are adjusted entirely by means of leads, that being the only guide as to their fit. They will usually stand being put out much finer than the crank pin or crosshead brasses, though it is often necessary to ease the nuts back a little after a few hours running. Main bearings will often warm up fairly rapidly to a certain point, after which they wil remain at that same temperature for the whole run. What is or is not a dangerous temperature can only be determined by judgment and experience, especially when it is considered that in the tropics the hand rails are frequently too hot to be held with the naked hand. However, we are not concerned so much in these articles with the running conditions, as with the overhauling and adjusting. Leads from main bearings will stand being from 26 to 32 B.W.G. according to size of shaft. An approximate rule is $1\frac{1}{2} \div 1{,}000$ for each inch diameter, but much will depend on known running conditions of the job. These are governed by the average temperature of engine room, method of lubrication, quality of oil used, and so on.

In the next article we will take up the opening up of the cylinders and the overhauling of pistons, valves, etc.

PERSONAL

Mr. W. Reese of Hamilton, has lately returned from England, where he secured the selling rights for Canada for the British Hele-Shaw Patent Clutch Co., of Oldham, England, and the W. R. Patent C. O_2. Recorder Co., Leeds, England. Mr. Reese spent four years in England during the war, being engaged on the testing and treatment of materials for heavy artillery in the inspection department of the British Ministry of Munitions. Previously he was for 8 years master mechanic of the Consolidated Mining and Smelting Company, at Trail, B.C., and Rossland Mines, B. C. Mr. Reese's engineering experience will be of value to purchasers of the equipment he is representing.

At the fourth annual convention of the American Gear Manufacturer's Association in Detroit, April 29, 30 and May 1, Mr. F. W. Sinram, president of the Van Dorn & Dutton Company of Cleveland was for the fourth time unanimously re-elected to the presidency of this association.

Eastern and Western Canada Marine Activities

MAY CORRESPONDENCE

British Columbia

OPTIONAL pilotage is now in effect in the British Columbia district, comprising all coast waters of the province with the exception of the Fraser River. Compulsory pilotage has been abolished, and in future shipping companies who want pilot service in the navigation of their vessels into British Columbia ports will have to deal independently with the pilots, who have banded themselves into an association. The larger shipping companies will in all probability continue to obtain pilotage services. The Pacific Steamship Company will be one of the principal beneficiaries under the new order of things. The company operates vessels between Victoria, Vancouver, Puget Sound ports and California, and while the old regulations were in force had to pay pilotage dues. Now that pilotage is no longer compulsory the company will not engage pilots at all. All parties seem to be satisfied wtih the new regulations, and even the pilots themselves seem to be contented. Abolition of compulsory pilotage came as a result of the repeated failures of the Marine Department to reach a satisfactory agreement with the pilots in respect to salaries. Some time ago the pilots expressed dissatisfaction with conditions, and a general superintendent of pilotage was appointed to act directly under the federal Minister of Marine. The superintendent drew up a new salary scale providing for monthly remuneration to $325 for British Columbia pilots, considerably in excess of the regular rate paid previously. The pilots were dissatisfied, however, claiming that the maximum should in no case be less than $350 a month. Colonel C. C. Ballantyne, Minister of Marine, has tried to give the claims of the pilots fair consideration. He finally decided that, in view of the fact that Vancouver, Victoria and Prince Rupert are now to be rated as great national ports with every prospect of becoming even greater within the immediate future, every facility should be provided for their unrestricted development. Compulsory pilotage has for years been criticized by coast commercial organizations as an expensive handicap to trade and port expansion, so it was felt that, to please everyone the best step would be to abolish the old system and make pilotage purely optional.

The headquarters of the new independent pilotage organization will be at Vancouver, with a sub-agency at Victoria. For fifty years pilotage was compulsory in British Columbia waters. Originally there was only one district specified, but three separate and distinct pilotage authorities were later appointed at Victoria, Vancouver, and Nanaimo. The first men in the province to secure pilotage licenses were Captains James Christensen and William Ettershanks. Both are still in the service and at the commencement of the year were retired to land duty. Compulsory pilotage has been in effect in British Columbia for over fifty years.

The newly-formed B.C. Pilotage Association has issued a schedule of rates as follows:

To or from William Head, Royal Roads or Brotchie Ledge into Victoria, or vice versa, 50 cents per foot draft and ½ cent per net register ton to a maximum of 3,500 tons. Regular line vessels calling at Victoria more than once on the same voyage, half the above rates for second or subsequent calls on that voyage.

Into Esquimalt, or vice versa: $1 per foot draft and ½ cent per ton nett register. Movage in Victoria Harbor or in Esquimalt Harbor, $10. Movage from Victoria to Esquimalt, or vice versa, $1 per foot draft. Vessels requiring the services of a pilot from Victoria to Port Townsend a charge of $20 will be made and $15 travelling expenses.

To or from Quarantine, Royal Roads or Brotchie Ledge into any port (other than Victoria, Esquimalt and the ports on the Fraser River), within the Gulf of Georgia, and as far north as Comox: $2 per foot draft and .01 cent per ton nett register.

Vessels calling at more than one port on the same voyage shall pay only $1 per foot draft and 1 cent per ton nett register on entering the second or subsequent ports, providing such port is not the port of Victoria or Esquimalt.

Vessels requiring the services of a pilot from or to Port Townsend will be charged an extra $10 if services are required beyond international boundary, also $15 travelling expenses.

In case of ships registered elsewhere than in Canada engaged exclusively in the coastal trade between Puget Sound and Alaska: Victoria—one cent per ton nett register to a maximum of 2,000 tons. Esquimalt—One cent per ton nett register. From off Victoria to any port in Gulf of Georgia, and as far north as Comox—$2 per foot draft and one cent per ton nett register.

If services are rendered from port limits only: $1 per foot draft and one cent per ton nett register, inwards, and a similar charge outwards.

In the case of a vessel calling at more than one port in the Nanaimo range, a movage charge of $25 will be made between the ports within that range.

Ports north of Comox and ports on the west coast of Vancouver Island: From off Victoria to Ocean Falls and return, $250. From off Victoria to Prince Rupert and return, $300. Vessels clearing from Vancouver for Ocean Falls, $200. Vessels clearing from Vancouver for Prince Rupert, $250. Vessels clearing from Union Bay or Powell River for Ocean Falls, $150. Vessels clearing from Union Bay or Powell River for Prince Rupert, $200. Vessels from Nanaimo and lower gulf ports, same as from Vancouver. These rates apply to vessels from gulf port limits and return to gulf port limits. A charge of $10 per day after the first 48 hours' detention, and accommodation and board to be provided pilot while attending ship. Intervening ports, or pilotage one way to ports specified. The rates will be proportionate with the above and all travelling expenses.

Movages—Vancouver: (1) Burrard Inlet between first narrows and second narrows, $10; (2) From below first narrows to above second narrows, $15; (3) from Burrard Inlet to False Creek or vice versa, $25; (4) From False Creek to above second narrows or vice versa, $25; (4) from False Creek to above second narrows or vice versa, $35.

Movages in coal ports—Movage in all coal ports, or other gulf ports, $10.

Transportation or boat hire to be provided when necessary.

Trial trips and compass adjustment: Attending vessel while adjusting compasses within port limits, $15. Attending vessel while adjusting compasses in gulf or straits, $25. Attending vessel on trial trip, including above service if carried out of trial run, $50 and one movage charge. This trial trip to cover twelve hours attendance if necessary.

When the service of a pilot is required to berth a vessel at quarantine station, or if a pilot is called upon to give service in and out of quarantine, a sum of $30 will be charged. If a pilot is detained at quarantine with a vessel a sum of $10 per day will be charged for such detention.

The above rates are applicable to all vessels and companies regularly employing pilots of the association.

Rates for service not herein specified will be given on application to the association.

A strike of firemen, sailors, deckhands and stewards on some of the coastwise steamers operated by the Canadian Pacific, the Grand Trunk Pacific, and the Union Steamship Company of British Columbia, has tied up shipping to some extent, especially in respect to northern British Columbia sailings. Several of the vessels, including practically the entire Union Steamship fleet, has been put out of commission as a result of the walkout, which at the moment of writing has no indication of termination. The men demand increased wages. The masters and firemen are taking no part in the dispute. Efforts to conciliate the issue were made by Fair Wage Officer T. D. Bulger, but the management of the Union Steamship Company declined, and Mr. E. H. Beazley, manager of the company, has given the statement that he will fight the strike to the last, even if it means the cessation of services for an indefinite period. The present schedule of wages, exclusive of board and berth,

which is free, is as follows: On the C.P.R. boats—Deckhands, $75 a month; quartermasters, $85; firemen, oil, $80, and coal, $90; stewards, $50.

The Harbor Marine Company, of Victoria, has been awarded a contract by the Canadian Pacific Railway for the building of a car-ferry for the run across the Gulf of Georgia, delivery to be made in October. The craft will have a carrying capacity of eighteen railroad cars and the dimensions will be: Length, 270 feet; beam, 48 feet, and depth, 12 feet.

The B. C. Marine, Ltd., Vancouver, will build a power schooner for the Hudson's Bay Company. The vessel will be used in carrying supplies to the company's trading posts in the Arctic, and is to be delivered to the operators in about six months. The B. C. Marine, Ltd., has just launched a small passenger boat for the Union Steamship Company of British Columbia, to be named the Capilano.

Neither of the two masters involved in the collision between the Prince Albert and Prince John near the Queen Charlotte Islands, March 30, will suffer as a result of the finding of the Dominion wreck commissioner, Capt. J. D. MacPherson, who holds that the circumstances of the accident were not such as to warrant the cancellation or suspension of the certificates. The two vessels crashed while enveloped in dense fog. Small damage was done.

Capt. M. A. Orford and Maj. Kirkpatrick Crockett, both employees of the Harbor Marine Company, Victoria, have gone to Ottawa to urge the Dominion Government to award additional steel ship contracts to the company. It is held that when the contracts for the first two vessels, now nearly completed, were awarded to the company by the Minister of Marine, it was clearly stated by Colonel Ballantyne that other orders would be awarded later, sufficient to keep the plant continuously busy for two or three years. There has been no hint from the Government since then regarding these additional contracts, and the company and its employees are beginning to grow uneasy. This feeling resulted in the decision to send a delegation to Ottawa to make a final plea that the Government's assurance be fulfilled. Seventy-five per cent. of the men employed by the Harbor Marine Company are returned soldiers. Hon. Gideon D. Robertson, Minister of Labor, has authorized the formation of a commission representative of all sides and vested with power to draft wage scales and working conditions for the employes of the Cholberg Shipyard in Victoria. The probable personnel of the commission will be: J. D. McNiven, deputy ministre of labor for British Columbia; E. B. McLeod, Victoria representative of the S.C.R.; James Dakers, representing the metal trades unions, and D. T. Bulger, Dominion fair wage officer. The Dominion Minister of Labor proposes that the draft be patterned along the lines of the Robertson agreement, which applied to various British Columbia shipyards.

Gyroscope stabilizers will be installed in the two new passenger steamers being built by the Pacific Steamship Company (Admiral Line) for the coastwise trade between Victoria, Vancouver, Seattle and California. The vessels will be equipped with electric turbine engines of such horsepower as to easily maintain a speed of twenty-five knots. Oil will be used as fuel.

President David Rodgers, of the David Rogers Shipbuilding Corporation, of Seattle, has abandoned possession of the former Skinner & Eddy yard No. 2, Seattle, and probably will not undertake the steel ship contracts offered him and which were said to aggregate about $45,000,000. Mr. Rodgers states that inability to get adequate backing from bankers and other interest, he was unable to go ahead with the project, which was to have given employment to 6,000 men and provided an annual payroll of about $10,000,000.

The big passenger liner Empress of Canada, which will augment the trans-Pacific service of the Canadian Pacific Ocean Services, Ltd., will be launched early in August, according to word received from the builders, the Fairfield Shipbuilding & Engineering Company, of Glasgow. The Empress of Canada is expected to sail from Liverpool, March 15, 1921, and will cruise around the world via Suez Canal, arriving in Victoria early in June. On reaching the Pacific the liner will inaugurate her regular sailings between Hongkong, Yokohama, Victoria and Vancouver. The Empress of Canada will be the fastest and most palatial liner on the Pacific, having a displacement of $22,000 tons, a length of 644 feet and a 77-foot beam, with depth of 54 feet, and twenty-knot speed.

The Achilles, a turbine-driven steamship of 10,000 tons gross, and now being completed in British shipyards, is to be commissioned shortly for the trans-Pacific service of the Holt (Blue Funnel) Line. The new Achilles will be the most modern type of Holt carrier afloat, although the turbine machinery will be modelled along the same line as that of the Tyndaresus. The original Achilles of the Blue Funnel Fleet was destroyed during the war. It is reported that the company contemplated augmenting its Pacific fleet extensively and that it will operate six liners on the run to the Orient before the end of the year.

Now that the peak of the present contract has been passed, the Harbor Marine Company, Victoria, needs more ship contracts to keep the steel yard running full blast. The company will launch early this summer two 8,100-ton steel steamships for the Dominion Government. Eighty-five per cent. of the employees of the yards are returned soldiers, and they have decided to send a delegation from their number to Ottawa to press for additional contracts. The Harbor Marine Company is practically the only steel shipyard in British Columbia that has not been awarded additional orders within the past year.

The cableship Restorer will shortly be dispatched to Far Eastern waters to effect repairs to the Pacific cable. It is proposed to shorten the cable in the vicinity of the Philippines and develop a new route by making use of some of the islands lying between the Philippines and North Borneo.

The wooden 2,500-ton steamship War Haida, built at Victoria for the Imperial Munitions Board by the Cameron Genoa Mills Shipbuilders, Ltd., has been sold to Italian interests and re-named the Rodosto. The steel steamships War Company and War Storm, built by J. Coughlan & Son, of Vancouver, and Wallace Shipyards, North Vancouver, are also reported to have been disposed of to the same interests.

The Nippon Yusen Kaisha has ordered two passenger steamers from Glasgow shipyards. Shortly after announcing a plan for building or buying 500,000 tons of freighters and passenger ships during the next five years, the company ordered two freighters of 8,000 tons gross each from the Mitsubishi shipyard and also three freighters of a similar size from a Yokohama yard. In pursuance of the same policy, the company has contracted to buy three other freighters from Japanese concerns and these will be operated in the Oriental service.

Six passenger carriers, the Fushimi Maru, Suwa Maru, Kashima Maru, Katori Maru, Tajima Maru and Toyohashi Maru, will compose the Nippon Yusek Kaisha fleet operating between Victoria and Seattle and the Orient during the remainder of the year, according to the company's revised sailing schedules. The Tajima Maru and Toyohashi Maru are both new to the trans-Pacific service and carry comparatively few passengers.

The three largest Japanese shipping companies, the Nippon Yusen Kaisha, Osaka Shoshen Kaisha and Toyo Kisen Kaisha, have applied to the Japanese government for permission to raise freight rates for the homeward voyages on their Australian, European, North American and South American runs, which are subsidized by the government. Apart from the bare fact of such an application having been made by these companies, their proposal is of interest as reflecting not only the condition of the country's carrying trade but of its foreign commerce. Roughly speaking, there are two different ways in which the freight market is affected by the general economic situation. When things improve with increasing exports and diminishing imports, freight rates for the outward passage go up, while homeward rates decline. The latest application shows that conditions are just the reverse. A rise in homebound freight rates will, of course, have the effect of correspondingly increasing the price of imports, but this increase will not be very considerable with regard to goods from Great Britain, France and some other countries where the rate of exchange is favorable to Japan. Exchange is, however, unfavorable with regard to the United States. Moreover, American freight rates are about the same as those charged by the Japanese subsidized companies, and it will not be easy, there-

fore, for the Japanese companies to raise the North American rates to any extent. Yet the increase in working expenses cannot be ignored. Increases in wages are most important. It has been said that Japanese seamen are drawing down almost as much money as seamen on British and American vessels. Fuel is also higher, and under the circumstances the Japanese government is inclined to regard an increase in rates as unavoidable.

All the steamships operated by the Nippon Yusen Kaisha on the trans-Pacific run are subsidized by the Japanese government now. Previously, only two, the Fushimi Maru and Suwa Maru, were subsidized. The Osaka Shoshen Kaisha has waived the subsidy this year in order to be strictly independent, and the company announces that it will endeavor to build up its steerage trade this year. The steerage accommodation on O.S.K. liners is said to be the finest on the Pacific, if not in the world.

The power schooner Iskum has been sold by the Clayoquot Cannery to the Siberian Trading Company. The Iskum was built at Coal Harbor, B. C., in 1912, under the personal supervision of the late H. C. Brewster, former Premier of British Columbia and partner of Mr. John L. Beckwith, of Victoria, present manager of the Clayoquot Cannery. The vessel has been used in the halibut trade and as cannery tender and is regarded as an ideal type of craft for northern trading.

MONTREAL NOTES

Activities in the port of Montreal indicate a very busy season, as the shipping now in the harbor shows a record for this period of the year. At the present time there are twenty-five vessels in port. Additional docking facilities have been acquired for the increased traffic that will come here this year, and to take care of the new routes that have been added to many of the steamship companies operating from this port. The first ocean arrival this season was the C.G.M.M. steamer "Canadian Aviator," which docked about noon on Sunday, April 26th, this arrival announcing the formal opening of navigation on the St. Lawrence. In accord with previous custom, Capt. Hilton, who was in charge of the vessel, was presented with a gold-headed cane as a souvenir for the first master bringing his vessel to port.

Alex. Peden has been appointed structural engineer for the Dominion Bridge Company at Lachine, Quebec. He will take charge of the structural drawing office.

The new steamship service between Montreal and West Africa, inaugurated by the Elder Dempster Line, was started this month with the loading and the sailing of the steamer Fantee. Several other vessels will shortly be placed on this route.

D. C. Tennant has been appointed designing engineer for the Dominion Bridge Company at Lachine, and will be assistant to F. P. Shearwood, who is in charge of all the erection schemes of the company.

The steamer "Cote Norde," an auxiliary schooner of 150, was launched on May 6th, from the yard of the McLean Construction Company of Mahone Bay, N.S. This vessel is fitted for passenger accommodation and will be driven by Gulowsen crude oil engines.

Thos. E. Peck, president of the Peck Rolling Mills, Montreal, died last Thursday after a short illness of two weeks. Mr. Peck was forty years of age, and has been manager of the Peck Rolling Mills since the death of his father, Jas. H. Peck.

P. L. Pratley, formerly associated with the Dominion Bridge Company as designing engineer, has accepted the position of chief of the valuation staff under Lt.-Col. C. N. Monsarrat in connection with the Department of Railways and Canals Valuation Board of the Grand Trunk Railway.

Sir James McKechnie, K.B.E., managing director of Vickers Limited, and one of the greatest naval architects and engineers in the world, is now in Canada in the interests of the British Empire Steel Corporation, and will make a tour of inspection of the Canadian shipbuilding plants which will be associated with this enterprise.

The pontoon recently completed and launched at the yard of the Davie Shipbuilding Company for the Canada Steamship Lines, and which will be used as a landing stage for the company's steamboat service at the port of Quebec, will be the largest of its kind in the world, being 225 feet in length and 45 feet wide.

Salvage operations on the Canadian Recruit, which went ashore last December near the mouth of the Saguenay River, are being successfully carried on by the Canadian Salvage Association of Quebec. The vessel has withstood the abnormal ice and weather conditions very well and it is more than likely that the vessel will be completely salvaged and eventually repaired.

H. J. Griswold, who in May, 1918, was engaged from the Dominion Engineering and Inspection Company to organize and operate the Canadian branch of MacGovern and Co., Inc., of New York City, is completing a two-year contract on June 1 and then will resume active participation in the affairs of the Dominion Engineering and Inspection Company, in which he is a partner.

The Red Star Line has inaugurated a new freight route between Montreal and Antwerp. The service was started with the sailing of the Western Star from the port of Montreal last week. The vessels used for this route will have a rating of from 8,000 to 10,000 tons gross, and it is expected that sufficient vessels will be acquired to give three sailings each month. P.V. G. Mitchell formerly of Montreal, is at present general manager of the Red Star Line at Antwerp.

At a recent meeting of the Sydney, N. S., board of trade, a resolution was passed calling on the Federal Government to subsidize the shipbuilding industry in Eastern Canada. It is believed that the recently formed steel corporation are considering the building of a shipbuilding plant at Sydney, and that the resolution is the result of an intimation of this kind.

A deputation of the Montreal Harbor Commissioners, headed by the chairman W. G. Ross, journeyed to Ottawa early in the month to confer with the Hon. C. C. Ballantyne regarding grants for harbor improvements. The result of the conference was highly satisfactory and the Minister of Marine has promised substantial allowances for carrying out the season's work in the port and all the necessary improvements to the channel and the harbor.

Friends of J. W. Lynch will be sorry to hear of his untimely death as a result of heart failure following an attack of pneumonia. For the past nine years he was general superintendent of the Rockfield plant of the Canadian Allis-Chalmers Company. He was connected for many years with the Metropolitan Water Board of Boston. He was well known in Canadian mechanical circles.

The immediate result of the release of ocean tonnage from the control of the British Ministry of Shipping, which has just been effected, is the increased cargo space that is available for Canadian exporters, and port officials here are anticipating this will give added impetus to the season's business. The final report of the British Ministry of Shipping shows that under their control, the total expenditure was in the neighborhood of $2,300,000,000; the total deficit being approximately $925,000,000.

E. P. O'Shea, who has been associated with the Customs office in Montreal for the past nineteen years, has resigned from the civil service to accept the position of assistant manager of the Universal Import Company of Montreal, Fall River and New York, dealers in various products of the West Indies. Mr. O'Shea has had a long training in the handling of perishable goods, and his new duties will be largely devoted to this class of product.

Recent Department of Marine estimates that have been passed by the House includes items of $1,500,000 for the maintenance and repairs to Dominion steamers and ice-breakers; $478,000 for dredging in certain portions of the St. Lawrence River between Montreal and the sea; $2,000,000 for the construction of a new ice-breaker to be used on the St. Lawrence. This last amount is for a vessel of 8,000 horsepower and will have a crew of about ninety men.

The American Waterworks Association will hold its 40th annual convention in Montreal from June 21 to 24, with headquarters at the Windsor Hotel, the Windsor Hall being reserved for an exhibition display, where many American and Canadian manufacturers of waterworks equipment will have exhibits. The meeting will bring many prominent hydraulic engineers from many points of Canada and the United States, and it is expected that about 1,000 delegates will be in attendance. Extensive plans are now in preparation for the professional meetings and entertaining features. H. G. Hunter, of Montreal, is the chairman of the entertainment committee.

The Canadian delegates to the International conference that will be held in Genoa in June, to deal with shipping matters and labor conditions as affecting seamen, will be C. J. Desbarats, Deputy Minister of Naval Affairs; Thos. Robb of the Shipping Federation, and J. G. Gauthier, chief representative of the Seamen's Union. These three men will represent the Government, the employers and the employees respectively. The subjects for consideration, as indicated by the agenda, will have to do with the

hours of labor and their effect on the manning and the accommodation of ships; articles of agreement; facilities for the employment of seamen; the Washington convention and its recommendations on unemployment and unemployment insurance; prohibition of the employment of children, and the possibility of establishing an international seamen's code.

The opening of navigation was fittingly celebrated this year at the yard of the Canadian Vickers Company, when the 8,300-ton Norwegian steamer Tatjana was launched. This vessel has a length overall of 413 feet, a beam of 52 feet and a depth of 31 feet 1 inch. She is fitted with triple expansion engines and three Scotch boilers, adapted to burn either coal or oil fuel, the boilers being equipped with Howden's forced draught system. The sponsor of the vessel was Mrs. Hans Johansen, wife of the chief surveyor of Norwegian Veritas in the United States and Canada. On Saturday, May 22nd, the Company launched the second vessel of the season, when the Norwegian steamer "Loch Tay" was placed in the water. The yard will be busy throughout the season on new contracts and it is anticipated that several other launchings will be made before the close of the year.

The formation of the Dominion Engineering Works Ltd., represents another enterprise of the Dominion Bridge Company, and the new organization, which will take over the present holdings of the Dominion Engineering and Machinery Co., a subsidiary of the Dominion Bridge Co. inaugurated last fall for the manufacture of paper-making machinery. The new company will, in addition to the manufacture of paper machinery and turbo equipment, engage in the production of all classes of heavy hydraulic and hydro-electric power equipment. The plant of the old St. Lawrence Bridge Company will be utilized for the new enterprise. The officers and directors of the new company are:— G. H. Duggan, president; A. J. Brown, K.C., vice-president; Julian C. Smith, vice-president; W. F. Angus, Geo. Chahoon, Jr., Sir Herbert S. Holt, Phelps Johnson, J. M. McIntyre, Howard Murray, H. Birchard Taylor, F. L. Wanklyn and R. Montague Davy, secretary-treasurer.

Clarence I de Sola, Belgian consul at Montreal since 1904, and a prominent business man in financial and shipping circles, died last week at Boston after an acute attack of indigestion. He was sixty-one years of age. For many years Mr. de Sola was president of the Canadian Zionists, a society which was started through his own personal efforts. In recognition of his services during the war he was knighted by King Albert of Belgium and created a Chevalier of the Order of Leopold. In business life he was largely interested in shipbuilding, bridge construction and hydraulic lift-locks. He was Canadian representative for Swan, Hunter and Wigham-Richardson Limited, and he built a great number of ships for the Canadian upper lakes and ocean trade, introducing the first two oil fuel combustion ships that ever crossed the Atlantic, the Toiler and the Calgary. As managing-director of the Comptoir Belgo-Canadian, he carried out some noteworthy works in Canada, among which were some of the locks in the Soulanges and Trent Canals, thus introducing in Canada the hydraulic lift-lock. He also took part in the re-tracking of a portion of the Intercolonial Railway and the Prince Edward Railway Company. He established a steamship service between Montreal and Antwerp. He was on the directory boards of many of the local shipping companies.

ST. JOHN, N.B.

The Canadian Pacific Railway Marine Services has disposed of the large tow boat Musquash now at St. John, N.B., to the Atlantic Salvaging Company, who will use her in connection with the steamer Le Canadienne. The Musquash is 110 feet long and equipped with an 800 horsepower engine.

The steamer Empress of the Bay of Fundy service has completed repairs and is again back on the St. John-Digby route.

Two large carriers are to be added to the Canadian-Australian-New Zealand service according to the New Zealand Shipping Company and in addition the Government steamer Canadian Ranger has been added to the service. The steamships to and from the Antipodes will run to Montreal in the summer and St. John in the winter.

The steamer Grand Manan, which has been off her route for several weeks, has been given a thorough overhauling and is ready to take her place on the St. John-Passamaquoddy route.

The steamers in the port of St. John, N. B., on May 15, 1920, were: Montcalm, War Peridot, Canadian Sower, Halesius, Caraquet, Tungus and the T. J. Drummond.

The winter port season for St. John, N.B., is about completed. The passenger steamers have been sent to the St. Lawrence, while many of the freighters have also shifted to the summer ports. The season has been one of the best in the history of St. John and there has been practically steady employment for those engaged in longshore work.

AN INTERESTING CASE

A recent decision rendered in the Exchequer Court of Canada in connection with the installation of patented apparatus on a foreign vessel built in Canada leaves somewhat open the question of Section 53 of the Patent Act. As there is at present before the House of Commons a Bill to amend and consolidate the acts relating to patents of invention, it might be opportune for our legislators to consider the re-wording of Section 55 of the proposed new act, which corresponds with Section 53 of the existing Patents Act. The section in question reads as follows:

> "55. No patent shall extend to prevent the use of any invention in any foreign ship or vessel, if such invention is not so used for the manufacture of any goods to be vended within or exported from Canada. R.S., c. 69, s. 53."

Under the judgment rendered in the Exchequer Court above referred to, the judge took the stand that the "raison d'etre" of this section was to obviate any chance of a patentee holding up a foreign vessel, and in this way hurting the trade and commerce of the country in which the patentee resided.

The case in question covered an attempt by a Canadian wireless concern to prevent United States manufactured apparatus, which was an alleged infringement of their Canadian patents, being installed in Canada on vessels built in Canada on behalf of the French Government, and this section of the Act was cited by the judge as a reason for dismissing the case, it being stated by him that these vessels came within Section 53 of the Patents Act.

It is suggested, however, that this interpretation of Section 53 of the Patents Act is somewhat at variance with the real "raison d'etre," for that section, as the justice himself, in his judgment, quoted the case of a Dutch vessel trading to an English port. It is quite obvious that Section 53 of our Patent Act was framed specially to deal with the question of foreign vessels calling at Canadian ports, and the object of the section is undoubtedly to prevent a patentee from interfering with such foreign ships to the detriment of the trade of the country in which the patentee is resident.

This application of the section is equitable, but, as the case in question covered the supply of alleged infringing apparatus to vessels building in Canada, it will be seen that a very formidable precedent has been made. In other words, a foreign Government, which has placed orders for the building of a ship in Canada, could secure in, say the United States, articles which are covered by patents in Canada, and instal such articles on the vessels in Canada in spite of any attempt the Canadian patentee might make to protect his interests in this country.

Whilst this might tend to promote the shipbuilding trade, it would certainly react very seriously against a number of subsidiary concerns who supply patented articles for ship use, as it takes no cognisance of any rights or privileges accruing to the proprietors of a Canadian patent in respect of a ship being built in Canada for foreign registry.

The judgment, from the foregoing standpoint, is certainly a very important one, and if such is the intention of Section 53 of the old act and Section 55 of the proposed new act, proprietors of Canadian patented articles, which form a part of the equipment of vessels, do not appear to be adequately covered in respect of vessels which are building in Canada on behalf of foreign owners.

BRITISH ENGINEERING EXHIBITIONS

The Machine Tool Trades Association of Great Britain has arranged to hold an exhibition of machine tools and kindred engineering products in Olympia, London, during the coming autumn. Practically the whole of the available space, which is very extensive, has already been booked. The British Electrical & Allied Manufacturers' Association will hold an electrical exhibition, probably in the same building during 1922.

Errors in Designing and Machining Bearings

The design and Operation of Journal Bearings as Presented at the Meeting of the American Society of Mechanical Engineers. This Should be of Interest to Designers in General

By C. H. BIERBAUM

IN considering the subject of bearings, their design, construction and lubrication, it is desirable to have in mind the fundamental laws relating thereto—those discovered by Tower, Thurston, Goodman, Lasche, Stribeck and others. Taking the work of these investigators in the light of what is now known concerning these laws, it follows that in the operation of a properly designed, constructed and lubricated bearing we may lay down the following ten principles:

(a) The bearing surfaces are completely separated by a film of oil.

(b) The friction of operation is the fluid friction in the oil film, and adequate thickness of film is essential.

(c) During construction proper clearance or space should be provided for a normal thickness of oil film.

(d) The advance edge of a bearing surface must be rounded or chamfered off in order to permit a supporting film of oil to form.

(e) The oil film forms most effectively upon a bearing surface, whose advance edge is at right angles to the direction of motion.

(f) An increase of speed increases the thickness of film, all other conditions remaining constant and clearance permitting.

(g) An increase in the viscosity of the oil increases the thickness of film, all other conditions remaining constant and clearance permitting.

(h) The larger the unbroken film of oil, the greater will be the average pressure-supporting capacity per unit area, other conditions remaining constant.

(i) Every unnecessary oil groove or interruption in the continuity of the oil film reduces the supporting capacity of the film.

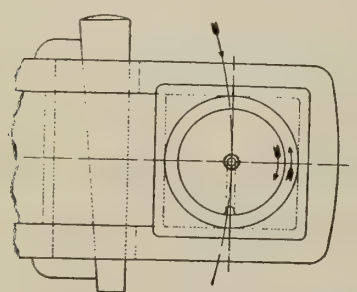


FIG. 1—PRACTICAL AND EFFICIENT METHOD OF LUBRICATING A CRANK-PIN BEARING.

(j) For every bearing condition there is a film thickness corresponding to maximum lubrication efficiency.

(2) The law governing the proper thickness of oil film has not as yet been investigated to the extent that the importance of the subject demands. In modern machinery the average thickness of film varies from 0.0002 in. to 0.006 in.

Precautions Regarding Oil Grooves

(3) Since the lubrication of every bearing is a study in itself, the application of the known laws can be discussed

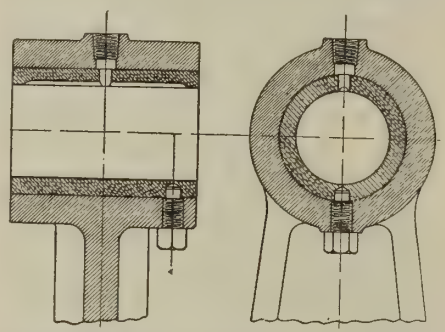


FIG. 2—TRANSVERSE AND LONGITUDINAL SECTIONS OF AN ORDINARY BUSHING DRIVEN INTO A CAST-IRON HOUSING.

to the best advantage by considering specific cases. Fig. 1 represents a theoretical ideal, as well as practical and efficient, method of lubricating a crankpin bearing, the journal receiving oil through the crankpin. The rotation of the crankshaft is in the direction indicated by the upper arrow, and in the position shown the engine is on a dead centre at a point of reversal of pressure. The direction of relative motion of the rubbing surfaces is shown by the two arrows at the right of the figure. The oil film enveloping the right half of the crankpin has been completely restored during the stroke just finished, since the oil groove passed over this half of the bearing while no pressure was being exerted upon it. After the dead centre has been passed, the entire pressure is then exerted upon the crankpin with its

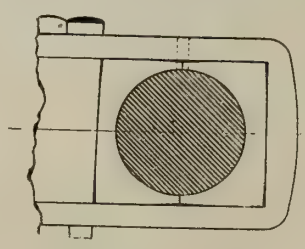


FIG. 3—PROPER METHOD OF FINISHING THE BRASSES OF A CRANK-PIN BEARING TO PROVIDE FOR NECESSARY EXPANSION IN SERVICE.

fully restored oil film, and at the same time the oil groove wipes over the other half of the bearing and restores its oil film while no pressure is being exerted upon it, after which it in turn is ready to receive a reversal of pressure upon a fully restored oil film. Thus both halves of this crankpin bearing present alternately, for the maximum pressure of each stroke, a complete and uninterrupted surface for maintaining the film on an area equal to the projected area of the crankpin, but it is impossible to obtain so perfect a condition of lubrication in a bearing having the old-fashioned cross oil grooves, which are still too often found in this class of bearing.

(4) In case the direction of rotation is to be reversed, the oil groove in Fig.

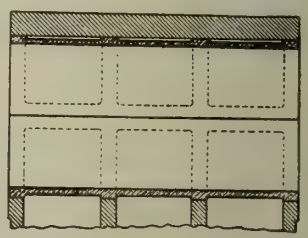


FIG. 4 — SPLIT BRONZE BUSHING OF TOO LIGHT DESIGN TO WITHSTAND THE STRESSES IMPOSED UPON IT.

1 should be placed diametrically opposite to its present position. The function of the oil grooves is, of course, that of supplying oil. In many cases they are necessary evils, which should be minimized as much as possible by avoiding a useless excess of grooves, and especially grooves in the direct line of maximum pressure of the bearing. Unless good and sufficient reason exists to the contrary, oil grooves should be cut parallel with the journal.

Disadvantages of Tight-Fitting Bushings

(5) One matter very frequently neglected, or not thoroughly understood, is that of driving in bushings. Fig. 2 shows a transverse and a longitudinal section of an ordinary bushing driven into a cast-iron housing. As all bearing alloys have a temperature coefficient of

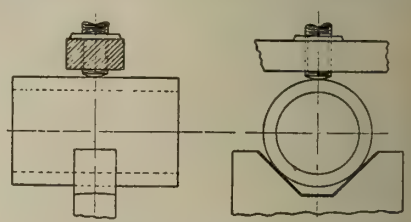


FIG. 5—IMPROPER METHOD OF CLAMPING A BUSHING FOR TOOLING.

expansion higher than that of cast iron, and as the bearing is directly subject to the friction of the journal, it follows that the bearing is at a higher temperature than the cast-iron housing and that all bearings must have an appreciable

outward expansion when in operation. For this reason bushings should be driven in with just enough pressure to prevent looseness during operation.

(6) The practice of driving in bushings so tight that they require reaming before they can be put into service cannot be condemned too severely. The

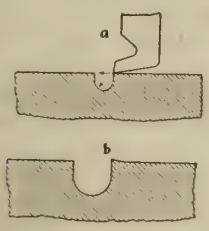


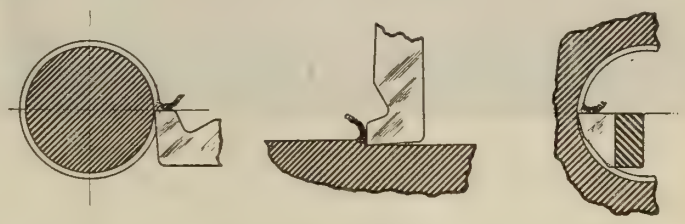
FIG. 6—SHARP EDGE PRODUCED AT THE EDGE OF AN OIL GROOVE BY AN ORDINARY TOOL.

subsequent reaming does not remedy the evil, in that a bushing driven in so tight will and must continue to contract inwardly when in operation, since the outside pressure upon it is not removed by the reaming. In the tooling of a bearing a definite amount of clearance should be provided for, in order to insure the best service conditions. When a bushing is driven in too tight, although it has been reamed before being placed in service, the amount of clearance which it will then have becomes a matter of guesswork and the amount of oil-film space provided an uncertainty. This condition frequently gives rise to heating and bearing troubles, even though the amount of internal contraction may not be sufficient to positively grip or stop the journal. The idea that bushings must be driven in tightly in order to hold them in place is fundamentally wrong, and excessive tightness of the bushing in its housing should always be avoided. For all ordinary machinery it will suffice if a bushing may be driven in place with a blow of the hand or with a small block of wood. The provision for fastening the bushing in place should be such that it will not bind or clamp the latter against outward expansion. In the construction shown in Fig. 2 a set screw engages a hole in the bushing, but does not, however, bottom in the hole.

FIG. 8—CROSS-SECTION OF THE TEETH OF A MOTOR TRUCK DRIVE WORM WHEEL.

Proper Method of Finishing a Crankpin Bearing

(7) The finishing of bearings in such a manner that they may expand while warming up is of very considerable importance, and this can be done in many cases by simply giving the matter the full consideration which it deserves.



a b c

FIG. 7—IMPROPER FORMS OF LATHE, PLANER AND BORING TOOLS.

Fig. 3 shows a crankpin bearing finished in a manner providing for necessary expansion in service. The two edges of the two half-bearings should be "brass bound," that is, they should bear solidly against each other and should exert a pressure against each other somewhat in excess of the maximum crankpin load. The outer surfaces of both bearings near these edges should be relieved so as not to bear upon the straps, as shown, somewhat exaggerated, in Fig. 3. The four corners of the bearings should be relieved in like manner so that the horizontal thrust will be mainly borne upon the surfaces falling within the area of the horizontal projection of the crankpin. A bearing thus constructed expands with the first slight increase of temperature, relieving the crankpin instead of clamping it as when these precautions are not taken.

Designing for Strength Important

(8) The matter of proper design of bearings as to strength is likewise of importance. Fig. 4 shows a bearing put in service by one of the oldest-established machine builders and which gave very considerable trouble. It is a split bronze bushing 12 in. long, supporting a journal 6 in. in diameter; the maximum thickness of the bushing was ⅜ in. and it was recessed on its back to a depth of ⅛ in. as shown, leaving a thickness for the larger part of the bearing of only ¼ in. The cap of the bearing was held down by ten ⅝-in. studs. Now it is obvious that by clamping this bearing the bearing surfaces were materially distorted by the pressure consequent on the tightening of the ten nuts. It is also apparent that the thickness of the recessed and unsupported part of the shell was not sufficient to withstand distortion under a fluid film pressure such as would normally be exerted upon it. The trouble with this bearing was therefore due entirely to the fact that it was too light a design.

(9) Mention may here be made of another class of bearings, which, together with their supports, are often improperly designed, namely, self-oiling ring bushings. These are nearly cut in half at mid-length in order to provide space in which the ring may operate, and the supporting wall beneath the bushing is slotted correspondingly at the centre to permit the insertion of the ring into the oil well. This often unduly weakens the bearing at a point where normally the greatest film pressure is exerted. In general, much of the trouble at present encountered in bearings can be overcome by simply increasing the strength and rigidity of the bearings and their supports, since an insensible amount of distortion and deflection is sufficient to produce all manner of annoyances.

Bearings Should Be Clamped Endwise For Tooling

(10) Another matter very often overlooked is that of the manner in which bushings or bearings in general are clamped during tooling. Fig. 5 shows end and longitudinal views of an improperly clamped bushing. With a ⅝-in. 16-thread set screw and the application of, say, a 50-lb. pull upon a 12-in. monkey wrench, a pressure of 50,000 lb., can be carelessly exerted upon the bushing in question, and it must be remembered that the composition of a bearing material is never one that would be selected for maximum strength. Bushings tooled when clamped

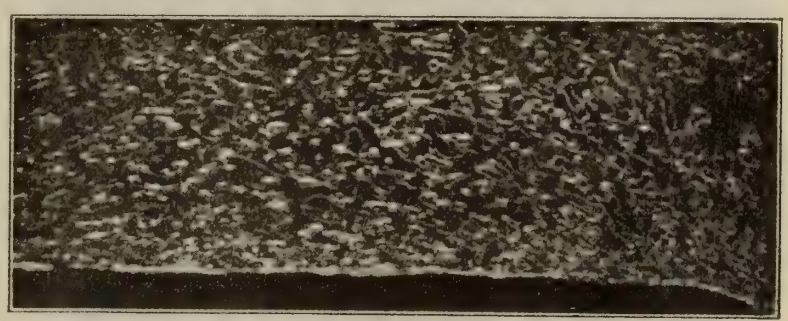


FIG. 9—PHOTOMICROGRAPH OF FIELD AT G, FIG. 8 (60 MAGNIFICATIONS), SHOWING DISTURBANCE OF CRYSTALLINE STRUCTURE DUE TO THE USE OF A DULL HOBB IN TOOLING.

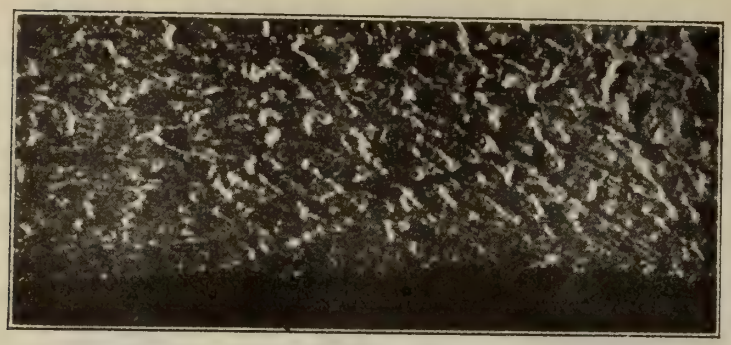


FIG. 10—PORTION OF FIG. 9—MORE HIGHLY MAGNIFIED (120 MAGNIFICATIONS) SHOWING CLEARLY THE COLD ROLLED EFFECT ON THE BEARING SURFACE OF THE TOOTH.

in the manner shown in Fig. 6 seldom have a bore that even approaches a true cylindrical surface, and if they are then driven upon an arbor and finished on the outside a very inaccurate product is the result, a bushing that can never give the most satisfactory service. The best and most satisfactory method of holding bushings for tooling is that of clamping them endwise. The importance of this is very generally underestimated; in general, bearings should be held in a manner such as to produce the least possible amount of strain and distortion.

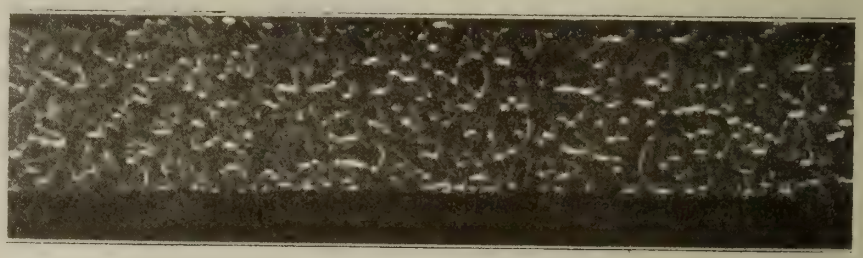
Chamfering the Edges of Oil Grooves

(11) The matter of chamfering oil-groove edges deserves special attention in that all advance edges of a bearing should be rounded and chamfered off, and the fact that this work should be done last, after all of the other tooling of the bearing has been completed, is important. At a, in Fig. 6, is shown an ordinary lathe tool at the edge of a groove on a finished surface. It is obvious that there are being exerted two forces upon any surface which is being tooled, one horizontal or parallel to the finished surface and the other vertical or in a direction normal to that surface. The resultant of these two forces is a force indicated by the dotted arrow, in a direction tending to deflect the edge of the groove obliquely downward, producing an effect which is shown somewhat exaggerated at b, Fig. 6. It can readily be appreciated what an injurious effect is produced in a bearing if any tooling is done after the oil grooves have been cut, especially so if the direction of rotation of the journal is opposite to that of the tooling. In all cases sharp edges of the groove prevent the formation of an adequate oil film and should be carefully avoided.

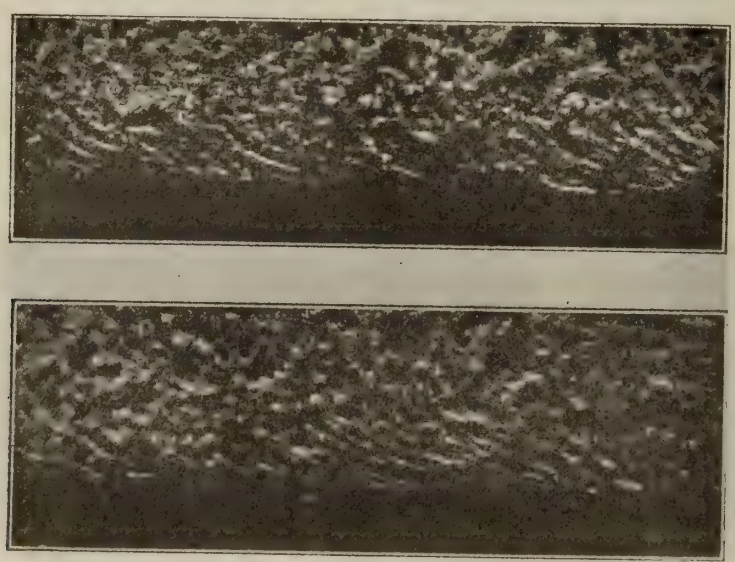
Why Bearing Surfaces Should Be Machined With Sharp Tools

(12) For best results it is very necessary and it is also general practice that a cutting tool should have rake. The tools shown in Fig. 7 would be readily condemned even by a person with a very limited shop experience, and no journeyman machinist would think of setting a lathe tool as shown at a, a planer as at b, or a boring tool as at c. In the last mentioned case the amount of normal or radial pressure which it exerts upon the finished surfaces is far in excess of what is necessary. Consider now the standard multiple-cutting-edge reamer which is very often used in finishing bearings. A 2½ in. reamer would have, say, 14 edges, and the amount of bursting or internal pressure that it would exert within a bushing would be at least 14 times that exerted in case the bushing were reamed with only one improper tool, as shown at c, Fig. 7. This practice is one that cannot be condemned too severely.

(13) The final finishing in bearings should be done by reamers or cutting heads having only one or a very limited number of cutting edges, and these cutting edges should have the proper amount of rake—such as would be given to any other proper cutting tool. Experiments made in a large manufacturing plant on bushings of the same dimensions, from the same lot of material, finished at the same time, some, however, being reamed with the standard multiple-cutting-edge reamer, and others with a single cutting blade, showed that, after a storage of six months, those bushings which had been reamed with a proper single cutting edge retained their accuracy and shape much better than those finished with the so-called standard reamer. The latter bushings exhibited a decided tendency to decrease in inside diameter, and to assume inaccurate, elliptical forms. It was also brought out at this time, that not only did a superior product result from the use of a proper tool, but that, by its use, the production could be increased from 15 to 20 per cent.



FG. 11—PHOTOMICROGRAPH OF EDGE 6, FIG. 8 (90 MAGNIFICATIONS), SHOWING THAT A SHARP TOOL WITH SUFFICIENT RAKE WILL NOT DISTURB CRYSTALLINE STRUCTURE.



FIGS. 12 AND 13—PHOTOMICROGRAPHS OF THE INNER EDGE OF A BUSHING FINISHED WITH A DULL BROACH (60 MAGNIFICATIONS), SHOWING MUTILATION OF THE SURFACE MATERIAL

Defects in Bearing Surfaces Revealed by the Microscope

(14) Another reason why bearing surfaces should be tooled with sharp tools having the proper amount of rake is brought out by a microscopic study of bearing surfaces. In order to obtain the full value of bearing alloys, it is necessary that these alloys should be presented as bearing surfaces having their natural crystallization undisturbed. The reason for this is given in the report of the Society's Research Sub-Committee on Bearing Metals. The hard or bear-

ing crystals should be embedded in a softer material, permitting the former to adapt themselves to the journal surface. The softer crystals, under proper service conditions, will wear slightly below the surface of the harder crystals. In order to retain these conditions, it is necessary to preserve the natural crystallization upon the bearing surfaces; but this cannot obtain where they have been mutilated by improper tooling. This mutilation of the bearing surfaces gives rise to the crushing of the harder crystals, and embeds these crushed particles into a compressed material which does not function as a normal bearing alloy.

(15) A very forcible illustration of this is furnished by the bronze worm wheel of a certain motor-truck drive in which the teeth had been finished with a dull hob, Fig. 8, showing a cross-section of one of the teeth. After giving unsatisfactory service, the worm wheel was examined in the usual way by chemical and physical tests, neither of which showed any defect whatsoever. On the other hand, microscopic examination showed that the trouble was due to improper tooling. Fig. 9 shows a photomicrographic section of a field at a, Fig. 8. This view clearly shows that the natural crystallization of the greater part of the arena has been disturbed, and that the edge of the tooth has had a cold-rolled or wire-drawn effect produced upon it by improper tooling. It is true this effect is not very deep; nevertheless, it is on the very surface which is brought into play when the worm wheel is put into operation. Fig. 10 shows a part of Fig. 9 more highly magnified, in which the cold-rolled effect upon the surface is seen to be even more complete, a condition which proved to be the sole cause for the very unsatisfactory performance which this wheel gave in service. Fig. 11 shows a magnification of part of the edge b of Fig. 8, the inner edge or surface of this wheel from which it is centred accurately to within a thousandth of an inch upon its spider. This surface had been tooled in a horizontal boring mill with a single cut, the tool set so as to produce a smooth finished surface. The cutting of this surface, however, was done with a tool that was sharp and had sufficient rake, showing that it is an easy matter to cut a bronze surface satisfactorily without distorting the natural orientation of its crystalline structure.

(16) Figs. 12 and 13 are photomicrographic sections of the inner edges of a bronze bushing which had been finished or tooled by broaching with a dull broach. These micrographs distinctly show what not to do; they show that the surface material has been distinctly mutilated, and that the compression of the material upon the bearing surface is very uneven.

THE WORLD'S LARGEST MOTOR SHIP

The motor ship "Afrika" built by Burmeister & Wain of Copenhagen, which recently ran her trial trips, holds the distinction of being the largest vessel yet built to be propelled by internal combustion engines. She was built for the East Asiastic Company, of Copenhagen, a line that has gone in strongly for this type of motive power, and which trades between Europe and the Far East. One of the features of the internal combustion engine as a motive power for ships is well illustrated in this latest vessel, as she can carry enough oil fuel in her bunkers to take her one and a half times around the world. This represents an enormous saving in time and money, by eliminating the necessity for frequent calls for fuel in foreign ports.

The "Afrika" is 464 feet, 6 inches overall length, and 445 between perpendiculars. She is 60 feet moulded breadth, and her moulded depth is 24 feet to lower deck, 33 feet, 3 inches to upper deck, and 42 feet to awning deck. She is 8597 tons gross register, and 5468 tons net register, with a deadweight tonnage of 13,300 tons. She has a capacity of 700,000 cubic feet of grain in her holds.

The machinery consists of twin screw four cycle standard Diesel marine engines, of the enclosed, forced lubricated type developed by Burmeister & Wain. Each engine has 6 cylinders, of 740 mm diameter and 1150 mm stroke, and the total horsepower developed is 4500 at 115 revolutions per minute. There is a three stage air compressor fitted to each engine for injection purposes, and these are of the enclosed forced lubrication type also. The auxiliary machinery, both above and below decks is electrically driven independently of the main engines. For the purpose of supplying current for the electric drive there are three auxiliary Diesel engines of 100 H.P. each, and a fourth engine of the same size is installed for the refrigerating machine. The speed developed on the trial trip was 13 1-4 knots.

The deck machinery is of the latest pattern, and all modern improvements for safe navigation and handling have been installed. The passengers, officers and crews accommodations have been designed with a view to the trade the ship will be engaged in, to secure a maximum of comfort in the hot weather.

An interesting point in connection with the engines of the "Afrika" is that they are the second set constructed for the vessel. When the first set was about half completed, the United States Shipping Board wished to acquire a set of engines of this type as soon as possible for investigation purposes. The East Asiatic Company gave their consent and the engines were transferred to the Board.

A COWES RECORD

A notable event in the unique history of J. Samuel White & Co., Ltd., of their long connection with the shipbuilding industry, and of Cowes, I. W., occurred on Wednesday, April 21st, when there was launched from their East Cowes shipyard the S. S. Argenne. She is the largest ship ever built in the Isle of Wight, though in far away times, 3rd rates of 70 guns were constructed at Cowes for the Royal Navy.

The Argonne is a single screw cargo steamer built to the order of Messrs. Delmas, Freres, of La Rochelle, and classed 100 A. 1. at Lloyds. Built of mild steel to J. Samuel White & Co.'s designs, she has the following dimensions: Length, overall, 293 feet; length, between rerpendiculars, 280 feet; beam, 40 feet; depth (moulded), 21 feet 6 inches; draught (maximum), 18 feet; deadweight, 3,000 tons. The vessel is divided into seven watertight compartments, consisting of forepeak, two fore cargo holds, engine and boiler space,, two after cargo holds, and after peak. The total cargo capacity of the holds is 132,700 cubic feet. One 5-ton winch and three 3-ton winches, supplied by Messrs Clarke, Chapman & Co., Ltd., are installed for handling cargo. The arrangement provides one winch at each cargo hatch. Four derricks of pitch pine are also provided, one at each hatch, the aftermost to lift, 5 tons, and the remaining three 3 tons each. Water ballast of 1,100 tons is arranged for in the double bottom, wings and peaks. The generating set for electric lighting is a 3.85 kilowatt direct-connected outfit, and the installation is being fitted by the builders. Accommodation is provided for a complement of 30 officers and men; the officers in the midship house and under the poop and the crew forward.

The propelling machinery, which has been constructed by the builders, consists of a set of vertical, inverted triple expansion surface condensing engines, with cylinders 19 x 32 x 52 inches bore by 36 inches stroke. Steam is supplied by two cylindrical single-ended return tube marine boilers 10 feet 8 inches long by 14 feet diameter, each having three corrugated furnaces, and fitted with Howden's system of forced draught. The working pressure will be 180 lbs. per square inch, and the speed in load condition, 9½ knots. A donkey boiler of the Cochran type will be installed. The circulating pump is a centrifugal unit furnished by Matthew Paul & Co., Ltd., while the auxiliary feed, ballast, and general service pumps are supplied by Thom, Lamont & Co.

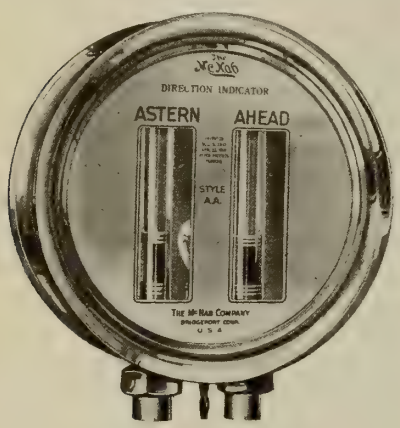
This steamer will be followed in due course by a sister ship, the Auvergne, now building for the same owners.

PROGRESS IN NEW EQUIPMENT

There is Here Provided in Compact Form a Monthly Compendium of Shipbuilding and Marine Engineering Auxiliary Product Achievement

THE McNAB DIRECTION INDICATOR

The McNab Company, of Bridgeport, Conn., have perfected an engine direction indicator, which is positive in its action, and of very simple construction. The indicating dial which is mounted on the bridge, either fore and aft or athwartships, according to the style of instrument, contains two glass cylinders, each containing a plunger, that for the ahead direction being red, and the astern direction red. If the instrument is installed in the fore and aft position, it has a double dial, and can be read at once from either the port or starboard side of the bridge, which is, of course, a great convenience to the officer in charge. The instrument is operated pneumatically, and there are no valves to get out of order. The operation is briefly as follows:



DIRECTION INDICATOR

A small pneumatic cylinder, with a piston having a stroke of 4 inches, is installed in a position over any part of the engine where a stroke of that length can be secured. From the discharge of this cylinder a pipe is led to a two-way cock, from which pipes are led to the ahead and astern indicator. The cock is provided with a handle, which is connected by a short connecting rod to the reversing shaft of the engine. The action is obvious. When the shaft is in the ahead position the cock is open to admit it to the plunger of the indicator which shows ahead. When the engine is reversed, the motion of the reversing shaft pulls the cock handle over, closing off the ahead side of the indicator and opening up the astern valve. The plungers are arranged so that the ahead plunger makes no sound as it rises and falls in the cylinder, but the astern plunger makes a slight noise, which of course would attract attention immediately. The delivery of air from the agitator as the air cylinder is called is intermittent, thus giving the plungers in the indicating instrument on the bridge a rising and falling movement, at each stroke of the engine. That is, the piston would rise to the top of the glass tube and fall back again in one complete revolution of the engine, thus constituting a counter as well as a direction indicator.

The Canadian representatives of the McNab Company are Messrs. N. E. McLelland & Co., 286 St. James Street, Montreal.

THE McNAB LOGOMETER

The McNab "Logometer" is a triple instrument, contained within a single 10-inch diameter polished brass cane, and is intended for installation in the Engine Room, in close proximity to the operating station, i.e., Maneuvring Valve.

The information given by the "Logometer" is as follows:

1st Direction Ahead and Astern of propeller shaft;

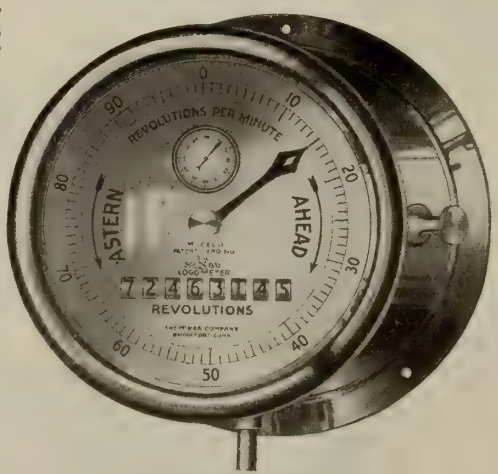
2nd Speed in revolutions per minute of propeller shaft; and

3rd The total number of revolutions the propeller shaft has made.

The instrument is strongly constructed and is operated by shaft transmission, the driving mechanism consisting of a bronze worm connected direct and surrounding the propeller shaft, no part of the driving mechanism being connected to the turbine itself.

All parts of the driving mechanism are thoroughly protected by a steel casing and provision is made to secure a liberal supply of lubricant.

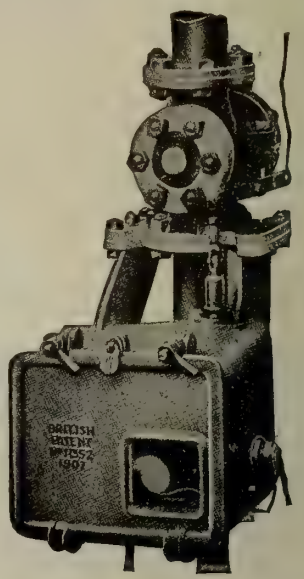
The McNab Logometer is built like a marine engine, but has the accuracy of a delicate instrument of fine precision.



INCHAB LOGOMETER

THE WILLET BRUCE WHISTLE CONTROL

A device for controlling the blowing of the steam whistle, and also for eliminating the condensation of steam in the exposed whistle pipe, is described herewith. The apparatus is known as the Willet-Bruce Whistle Control. It is electrically operated, current being obtained from any convenient circuit. The following description will make the operation clear:



WHISTLE CONTROL VALVES

The Willet-Bruce valve is installed at the base of the whistle pipe adjoining the boiler casing, therefore as no valve whatever is installed on the whistle, any condensation within the exposed whistle pipe falls by gravity and is automatically drained off by the special drain outlet provided in the construction of the Willet-Bruce valve for that purpose.

The entire whistle pipe is therefore kept entirely free from moisture, this ensures a volume of dry steam to the whistle when the valve is opened, resulting in a clear, penetrating, crisp blast from the whistle under all conditions of weather. The valve is installed at a location where it is easily accessible for overhauling if necessary, and will not freeze up.

The ordinary whistle valve is installed directly underneath the whistle, this installation confines the steam in the entire length of the exposed whistle pipe, thereby turning the pipe into a condenser, due to its exposure to the elements and the rush of cold air surrounding it, the result being, that when the lanyard is pulled, a volume of water is forced through the whistle instead of dry steam.

Further, in extreme cold weather, this valve, and in many cases the steam pipe itself, becomes frozen up.

The ordinary valve is installed in such an inaccessible location, that thawing out and overhauling it is made abortive. So great have been the advantages of the Willett-Bruce system, that practically every important ship-builder is now

making installation on new tonnage contracted for throughout the United States and Europe.

Among the chief advantages, mention may be made of the following:

Dry steam at all times.

Sensitive and absolute control.

Instantaneous action.

Clear and distinct blasts.

No valve required in the whistle itself.

Compactness and accessibility.

All working parts grouped together.

Ordinary hand lanyard available at all times as standby.

The main operating valve is placed at a position in the steam pipe about two or three feet above the boiler casing, or similar position, by which means the exposed portion of the steam pipe is kept free of steam, except when the whistles are in blast, thus reducing the condensation to a minimum, and any steam condensed during the working of the whistle is drained away by the automatic valve.

The control box, which is a watertight case containing the electric and timing mechanism, is placed immediately below the main operating valve, thus making the whole installation very compact.

The electric power necessary to operate the control is very small, and may be very conveniently taken from the lighting circuit on the navigation bridge, but it should not be taken from the navigating circuit or the Marconi circuit.

The Canadian agents are Messrs. L. E. McLelland & Co., 286 St. James St., Montreal.

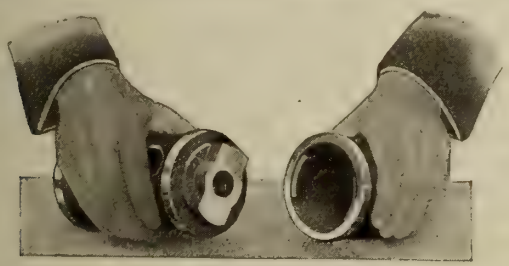
ROBERTS UNIT JACKS

The Roberts Mfg. Co., New Haven, Conn., handle a line of unit jacks and bolt couplers which should interest the mechanic in general. These jacks can be set to any height instantly by means of separate and interchangeable units. One merely builds up the proper number of units required and adjusts their rack jack. Lock joints connect each unit and are locked in place by means of a simple turn.

A surface gauge connection is also made, which can be clearly seen in the illustrations.

FROM LEFT TO RIGHT WE HAVE A TOOL-SETTING STAND, A LEVELING JACK, AND A SURFACE GAUGE CONNECTION.

Readers can no doubt obtain all necessary details from a study of the various illustrations and will readily understand the advantages of such a system, especially for machine set-up work. All these jacks are made of first quality malleable iron, and will stand the strain placed on them in supporting work. These shop aids, as we might term them, are ideal for use on planers, vertical millers, horizontal mills, radial drills, boring mills, slotters, shapers, or in fact any machine upon which work has to be strapped in place. The erecting department will also find them of splendid service.



THIS ILLUSTRATES THE LOCK JOINT. A SINGLE TURN FIRMLY LOCKS THE UNITS.

SOME EXTENSION UNITS AND RACK JACK.

This concern will also turn out what is known as an instant bolt coupler. By referring to the illustration showing work jacketed up and clamped, one can see a coupling in actual use.

This attachment is claimed to save the time and cost of making special bolts for special jobs. With the aid of coupler any length of bolt can be had by coupling up bolts you already have. Better still use studs for greater economy, for each bolt retains its own nut. These couplers are also made of malleable iron, and are designed to withstand high strains.

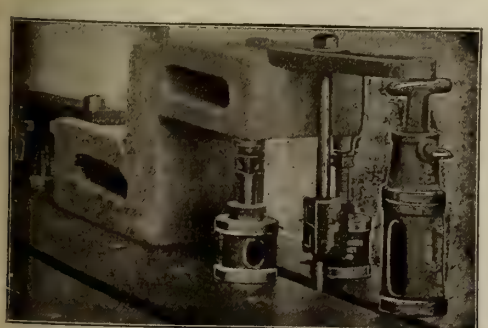
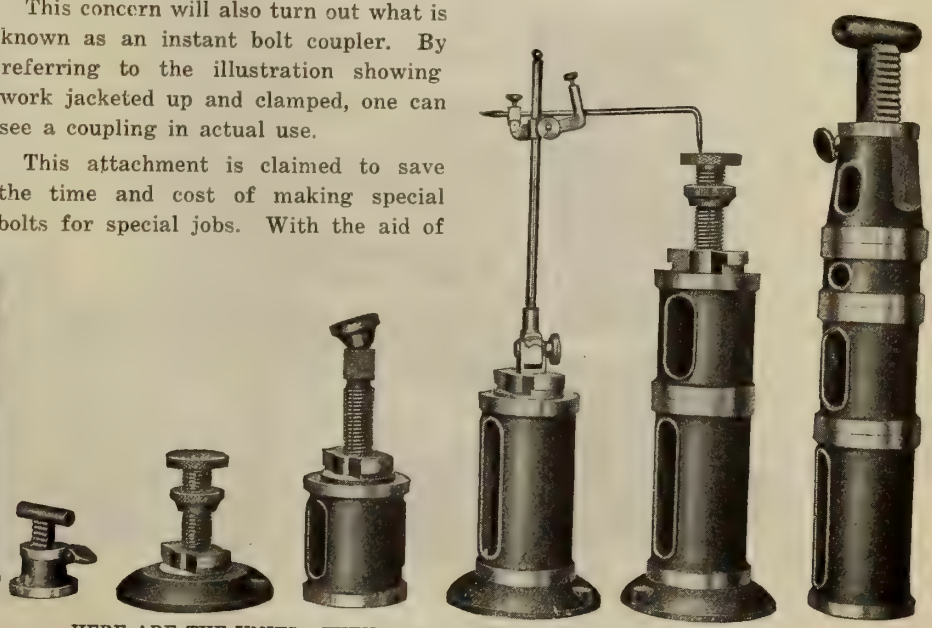


ILLUSTRATION SHOWING BOLT COUPLER AND JACKS IN USE.



HERE ARE THE UNITS. THEY CAN BE BUILT UP TO SUIT THE JOB.

The L'Air Liquide Society announce that their plant at London, Ont., is now in operation, and producing at full capacity. This is the seventh plant in Canada to be completed, and at present there are two others in course of erection, one of which will be in operation within a month of two. This news will, no doubt, be of interest to those requiring oxygen for use in their plants.

HIGH POWER MILLER

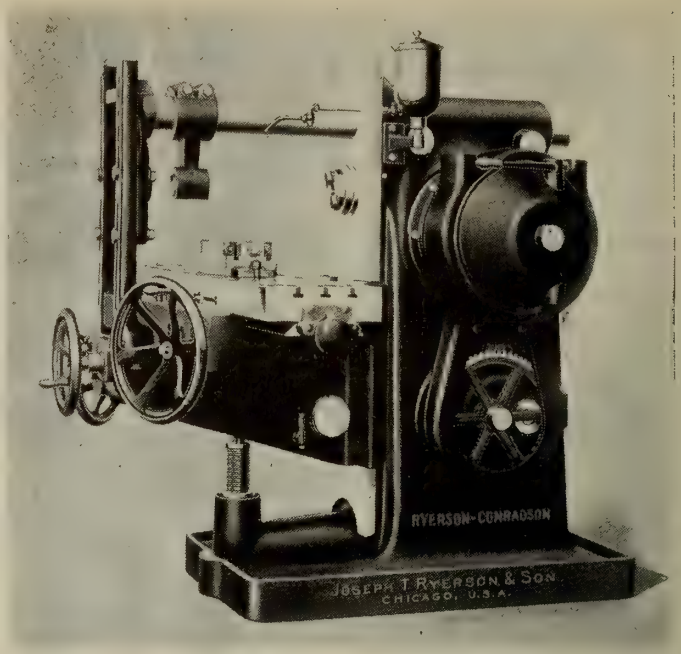
The first machine to be marketed by the new Ryerson-Conradson Company is that of their No. 3 helical drive high-power miller. This machine is claimed to include new features which will place it among the leaders in the machine-tool field.

The most striking feature in the design of this machine lies in the application of the helical drive. Helical drive gearing is not universally employed in milling machines, due to the inability (up to the invention of the type described) to secure a sufficient range of speeds as required of a commercial milling machine.

The column is an exceptionally rigid casting, thoroughly ribbed internally and cast integral with the base. Surrounding the base is a deep flange which materially stiffens it and serves as an oil retainer. The face of the column is extended above the overarm, affording very firm support for special fixtures.

The knee is heavy and deep, absorbing all vibration due to heavy cuts. The bearing surface between the knee and the column is greatly increased by extending the back of the knee up to a point nearly level with the top of table. The elevating screw telescopes and is located in the centre of gravity to avoid all binding action when raising or lowering.

The table and saddle is provided with large bearing surfaces and the table is provided with three T-slots ⅝ in. wide, and a large groove to retain and lead all cutting compounds to the drain.



AS IT APPEARS FROM THE REAR.

The spindle is of .60 carbon steel, accurately ground, running in bearings of phosphor bronze, scraped to fit. The front bearing is tapered and both bearings are adjustable for wear. The faceplate is forged with integral spindle and arranged with two large keys for driving face mills and arbors.

The primary shaft is driven by means of a constant speed pulley on one end and three change gears on the other, which drive a hollow shaft concentric with the primary shaft. This hollow shaft is also provided with two additional change gears, and, in turn, drives either the high speed or low speed set of helical gears which effect the spindle drive. By this method twelve spindle speeds are obtained, ranging from 17 to 290 r.p.m., in practically geometrical progression.

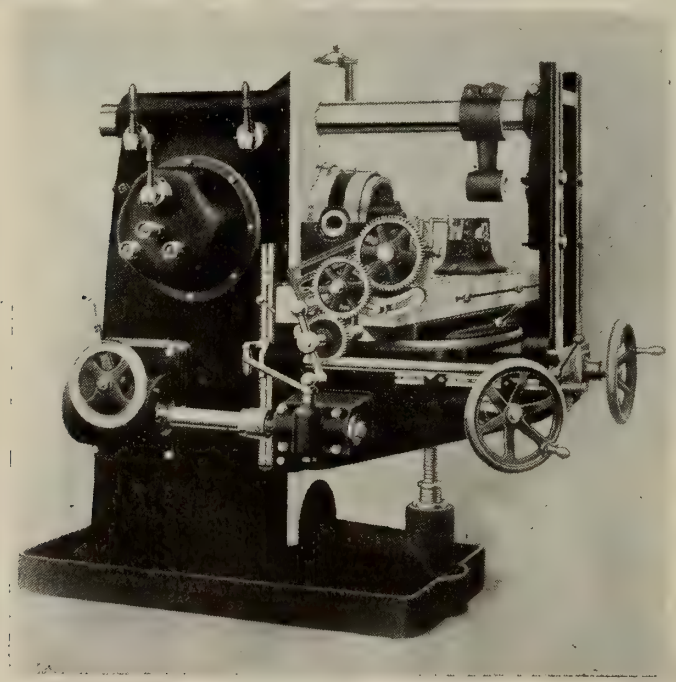
The driving pulley is of the conical friction clutch type and means are provided to automatically apply a brake to the shaft the instant the clutch is disengaged.

The feed drive is positive from the primary shaft by means of a chain and sprocket. Eight changes are provided by the usual cone of gears in connection with a dive key controlled by a hand wheel, on the circumference of which the various rates of feed are indicated. Two sets of gears, operated by a hand lever, double up the eight feeds, and by this method sixteen feed changes are obtained, ranging from .6 in. to 22.3 in. per minute.

Each feed screw is provided with a graduated dial reading to the thousandths of an inch and readily set back to zero. All feeds are equipped with fixed trips and one adjustable trip which can be placed to stop the table at any desired position along its travel.

These machines are driven at a constant pulley speed of 600 r.p.m., requiring from 5 to 7½ h.p. to operate. The gears run immersed in oil and are completely enclosed, making them dustproof, and owing to the flooded lubrication are practically noiseless. As the driving pulley is also enclosed the machine conforms to all safety regulations of the Workmen's Compensation laws. All thrust is taken up by S. K. F. ball-bearings. All bearings are bronze bushed. Change gears are all cut from solid chrome nickel steel stock and are heat-treated; all others are of steel or bronze, no cast gears being used, with the exception of the large elevating bevel gear, which is of cast steel.

Following are the machine's principal specifications:



FRONT VIEW OF THE MACHINE.

HIGH POWER MILLER

Type of Machine.	Plain	Universal
Longitudinal movement	35"	34"
Cross traverse movement	14⅝"	13"
Vertical movement	20"	18½"
Diameter of spindle nose	5 1-16"	5 1-16"
Spindle, front bearing, large end	4¼"	4¼"
Spindle, front bearing, small end	3¾"	3¾"
Spindle, rear bearing	3⅛"	3⅛"
Taper hole in spindle	No. 11 B. & S.	No. 11 B. & S.
Hole through spindle	13-16"	13-16"
Distance, spindle centre to bottom of arm	6 5-16"	6 5-16"
Distance, end of spindle to arbor bushing	27"	27"
Distance, face of spindle to arm braces	30⅜"	30⅜"
Diameter of overarm	4⅜"	4⅜"
Table dimensions	63¼" x 12¾"	63¼" to 12¾"
Table working surface	53" x 12¾"	53" x 12¾"
Spindle speeds, range	17 to 290 R.P.M.	17 to 290 R.P.M.
Spindle speeds, number of changes	12	12
Feed range per minute	6" to 22.3"	6" to 22.3"
Feed, number of changes	16	16
Floor Space—		
Parallel to spindle	76½"	76½"
At right angles to spindle	111"	111"
Pulley speed	600 R.P.M.	600 R.P.M.
Pulley diameter	14"	14"
Width of belt	4"	4"
Horse-power required	5 to 7½	5 to 7½
Weight, net	5,575 lbs.	5,910 lbs.

BEAVER CHUCK AND COLLET

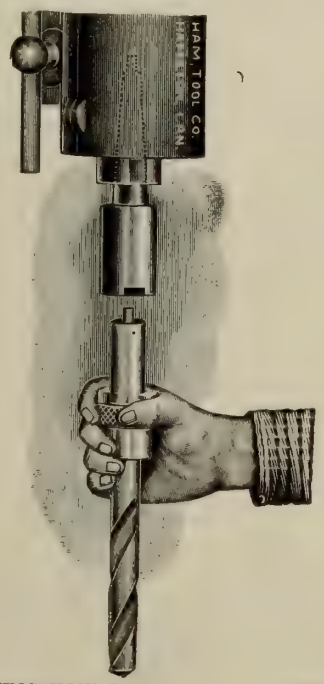
The Hamilton Tool Co., Ltd., Hamilton, Canada, have placed on the market what is known as the Beaver clutch and collet. This tool is patented and is especially designed to be used in the rapid interchange of drills, reamers, counterbores, etc., on any machine without stopping the machine. Of course the device is especially useful for drill press work.

These chucks and collets are made of high grade tool steel and are very simple in construction, positive in operation, and have proven great time savers. A self-contained device releases the collet and tool instantly, requiring neither hammer, wrench, nor key to operate. And it only requires one hand to do it. There is nothing to catch the operator.

Chuck is fitted with a Morse taper shank of the required taper to fit the machine spindle, and is bored so that each collet of the set will fit snugly into it. The collets are bored to take tools having either Morse taper or straight shanks, as required.

Lengthwise of the collet shank is set in a narrow strip of steel which is kept in position by means of a pin and spring. On this steel strip is a catch, which, when the collet is engaged, fits into a groove on the inner side of the chuck, thus holding the collet and tool firmly in position. The inner side of the knurled ring is so constructed that when grasped between the forefinger and the thumb and pulled outward the catch is instantly released, thus freeing the collet and tool from the chuck, which still remains firm most effective method of knocking out tools.

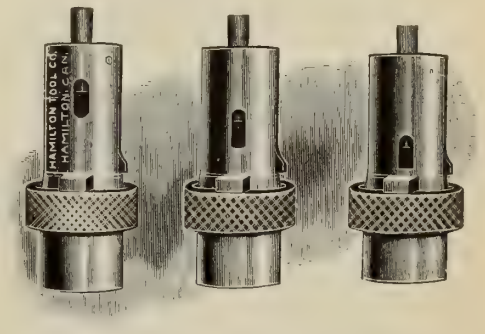
To engage the collet grasp it by the knurled collar and push into the chuck.



SHOWING HOW EASY IT IS TO OPERATE.

GENERAL VIEW OF COLLET FOR NO. 1 CHUCK. NOTE THE EJECTING PIN AT THE TOP.

in the machine spindle. A spring steel wire firmly seated in a groove around the collet prevents the knurled ring from coming off when being pulled outward to release the collet. The sliding pin in the end of the collet is a very simple and



SOME OTHER VIEWS OF THE COLLETS.

To disengage the collet, grasp it by the knurled collar and pull straight out from the chuck. The various illustrations explain fully the design of the chuck and its uses.

The Halcomb Steel Company of Syracuse, N.Y., publishes prominently in its plant organ, under the heading of "Who's Who in Safety," each month, the names of all foremen in whose departments there were no accidents during the previous month. Directly opposite, under the heading "Those Who Spilled the Beans," are published the names of the other foremen, with the number of accidents charged to his department after each name. The Corn Products Refining Company, Chicago, last October conducted a safety drive among all its plants, at the close of which a bulletin was posted, showing the name of every foreman in whose department one or more accidents had occurred, together with the number of accidents in each department.

Discussing the effect of such publicity, Grover Kingsley, safety engineer of the Halcomb Steel Company, writes: "This has proven a stimulus to good safety work in a great number of instances. Foremen want to keep their names out of the 'Who Spilled the Beans' Column. Contrary to expectations, this sort of publicity does not create antagonism to safety, and I attribute this principally to the humorous phrase used to designate foremen whose departments show accidents."

The Greenfield Tap & Die Corporation, Greenfield, Mass., have issued a new book, known as their catalogue No. 43. This book contains not only a detailed description of their line of gauges, but some mighty interesting and useful tables as well. To the mechanic, purchasing agent, etc., we can safely recommend the worth of this catalogue, for it will not only familiarize them with the Greenfield line of gauges, but act as a handy text-book besides.

CYLINDER TEST GAUGE

The Federal Products Corporation, Providence, R. I., have placed on the market an interesting cylinder test gauge which is herein illustrated and described. This gauge detects tapered, scored or out of round cylinders, and referring to illustration we note as follows:

The gauge feelers project from casing (A). These feelers are actuated by means of a cone cam (inside the casing) which is directly connected by a steel rod running through the body (B) to a rack and spur movement that operates the dial hand. The button (C) which projects through the knurled sleeve is attached to the steel rod. By pushing down the button, the cone cam is likewise lowered, thus permitting the feelers to recede sufficiently to be inserted in the cylinder. When the feelers are inside of the bore, pressure on the button is withdrawn and the feelers are automatically released against the cylinder walls.

Provision has been made for building up one of the three feelers (D) so that with a set of extensions, measurements can be taken of any diameter between 2½ inches and 6½ inches. This is accomplished in the following manner: Nipples (G) are made in different sizes to cover any fractional part of an inch. These nipples fit interchangeably into the extension rods (E) which vary in length by 1-inch steps, and which are in turn supported by threading bushings (F) to match.

The gauge dial is graduated in .001 in. with sufficient space between calibrations to allow variations of .0005 in. to be easily perceptible and it always remains in plain sight, and is never buried deep in the bore so as to necessitate the manipulation of lights and mirrors to obtain a reading. It can be set to any position with reference to the hand by turning the knurled bezel. The function of the master (H) is to furnish a means for setting the gauge accurately to a standard diameter. We can furnish masters of the type illustrated, to any diameter specified.

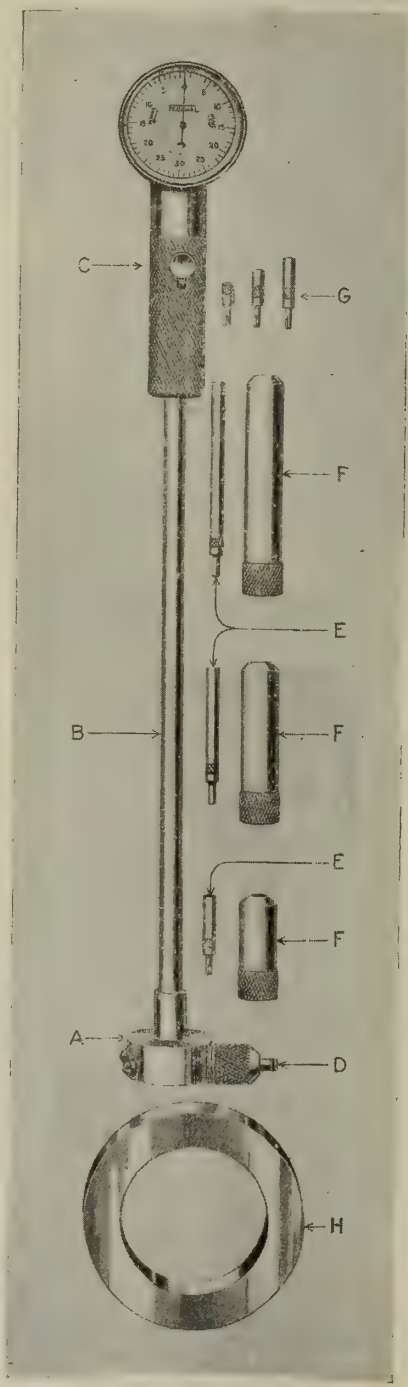
Where the gauge is to be used to measure the variations from one standard diameter as is the case with motor manufacturers and many service stations, extensions (G), (E) and (F) will ordinarily not be required. In such instances, the feeler D is made solid.

Method of Operation

In practice the feelers before insertion in the cylinder are set to a master (as illustrated by cut H), while at the same time the face of the dial is turned until the hand is coincident with the zero. The feelers are then introduced into the cylinder bore and applied to any part of the cylinder wall desired.

The instrument is rocked from side to side, in a fashion similar to that employed with inside micrometers. The position of the hand at the high point records the plus or minus variation from the standard diameter.

The feelers always bear with uniform pressure on the sides of the cylinder



DETAILS OF GAUGE

walls, so that readings are in no way dependent on the human touch and are thus accurate and positive. An added advantage is also derived from the fact that the gauge can be applied regardless of the position of the cylinder block.

The Homestead Valve Mfg. Co., of Homestead, Pa., announces the removal of its New York office to No. 242 Lafayette St., New York City. The new office is on the third floor and is several times the size of its former location; the removal having been found necessary, due to the expansion of its New York business. The New York office is in charge of Mr. P. L. Rhodes, who has with him Mr. William Gormly, Mr. John Gormly, Mr. George Nagle, Mr. C. A. Tyler and Mr. W. B. Goering.

SUPERHEATED STEAM IN TURBINES

It is generally estimated that the gain in economy due to the use of superheated steam is about 1 per cent. for every 10 deg. of superheat. Thus, if steam having 150 deg. of superheat is employed, the resulting gain should be 15 per cent., irrespective of whether the steam is employed in a reciprocating engine or a turbine. There are certain disadvantages which follow the improper use of super-heated steam, the two most important of these being the effect of high temperature on the castings of the engine, causing distortion; and the difficulty of lubrication. In the turbine the effects of distortion may be particularly serious in view of the fine clearances which have to be adopted with certain types of turbine, and it may be stated that one of the reasons why the high-speed impulse type of turbine is adopted is because with this type, owing to the high velocity of the steam, the clearances can be made more generous in both the axial and the radial direction. It is, however, advantageous to keep that portion of the turbine which is exposed to the effects of highly superheated steam as small as possible, and for this reason in the first set of nozzles the fall of pressure is often about two-thirds of the total fall between boiler and condenser, so that on leaving these nozzles the temperature of the steam has fallen to such a degree that its effects are greatly reduced.—"Shipbuilding and Shipping Record."

STEAM USED BY JETS

A recent article in "Engineering" gave some interesting results of investigations made into the amount of steam used by jets. The average figure is very much above what is usually estimated as the consumption of apparatus for increasing draught. The tests were made with nineteen varieties of boiler-firing apparatus in which steam jets are used, and the highest consumption noted was 21.4 per cent. of the steam produced. The lowest was 0.5 per cent., and the average 6.6 per cent. These figures should furnish some food for interesting thought.

The Locomotive Superheater Company, 30 Church Street, New York, have issued a new bulletin, T-5. This bulletin covers the advantages of superheated steam. The context presents the engineering reasons for these advantages from a new angle. The argument is clear and concise and should be of interest to all power plant owners and operators in every industry or power plant service.

CANADIAN VICKERS LAUNCH A NEW VESSEL FOR NORWEGIAN FIRM

THE fourth vessel, built by Canadian Vickers, Limited, for Norwegian interests, was launched by Miss Ida Bodin, sister of the Resident Surveyor of the Norwegian Veritas in Montreal.

The vessel, which is named "Loch Tay," was built for Mr. Alf. Monsen, Toensberg, under the supervision of Capt. Andersen and Engineer Haugerud for the owners, and Mr. F. H. Bodin, representing Mr. Hans Johnsen, Chief Surveyor of the Norwegian Veritas. She will be completed and ready for cargo in about three weeks.

The vessel is 413 ft. over all, has a beam of 52 ft. and is 31 ft. 7/8 in. deep. Her draft, when loaded with 8,300 tons of cargo, will be 25 1-3 feet. She is fitted with triple expansion engines and three Scotch boilers, adapted to burn either coal or oil fuel, boilers being fitted with Howden's forced draft system. About 1,500 tons of fuel oil are carried in the double bottom tanks and in a deep tank amidships.

The equipment for handling cargo is up to date in every respect; the cargo winches and windlasses being of Clarke-Chapman design, the steam steering gear being of Hastie horizontal type, all manufactured by Canadian Vickers, Limited. Steering from the navigating bridge is by means of a telemotor of MacTaggart-Scott type, made by Robert Mitchell Co., of Montreal, and also by hand steering gear on the poop deck. There is the usual complete equipment of mechanical engine-room and steering telegraphs.

The equipment and accommodation for officers and crew are very complete, being up to the latest requirements of the Norwegian Sea Control Authorities. In addition to the ordinary equipment of boats, one of the life-boats is equipped with a gasoline motor, and there are also two life-rafts.

Miss Bodin who was accompanied by her brother, Mr. H. Bodin, was received on behalf of Canadian Vickers, Limited, by Mr. A. R. Gillham, the managing director, and Mr. P. L. Miller, the general manager.

CONVERSION OF "KIL" CLASS GUNBOATS INTO CARGO STEAMERS

The eight vessels now being converted by J. Samuel White & Co., Ltd., East Cowes, I.W., are the Kilmelford, Kilmarten, Kilmuckridge, Kildavin, Kilmead, Kilmallock, Kilmore, Kildorry.

The majority of these vessels were built by Smith's Dock Co., at Middlesborough, and their dimensions are, generally, as follows:—Length, between perpendiculars, 170 feet; beam, 20 feet, 10 inches; and depth, moulded, 16 feet, 6 inches.

The conversion is being carried out in compliance with British Corporation Rules Class B.S.*, and the work includes the straightening of the stem (these boats are double-enders) and the building of a forecastle.

All are equipped with two boilers. The forward one has to be removed and the space adapted to a cargo hold.

The existing triple expansion engine will remain in its original position, and will give a speed of about 10 knots.

The conversion allows for a deadweight capacity, including bunkers, of 650 tons, of which the coal bunker capacity is to be 80 tons. The forward cargo hold is to have a capacity of 23,000 cu. ft., with a cargo hatch 38 ft. by 19 ft., and the after cargo hold 5,900 cu. ft., with a cargo hatch of 22 ft. by 11 ft.

Two steel masts are to be fitted to each boat, and a wood derrick having a 3-ton lift is to be placed each mast. A cargo winch 6 inches by 10 inches will be fitted at each hatch.

Accommodation has to be provided for 19 officers and men in each ship. The crew will be berthed under the forecastle, and the side plating amidships will be extended to enclose the bridge space, where accommodation will be provided for the officers on the main deck, while the chart and wheel house will be on the bridge deck.

From start to finish the work of conversion will average about two months for each ship.

LAUNCHING OF S. S. "CANADIAN RUNNER"

On Saturady, May 8th, at 12.30 a. m., the Port Arthur Shipbuilding Company, Limited, launched the S. S. Canadian Runner, built by them for the Department of Marine of Canada.

At the request of the Minister of Marine, Mrs. James Whalen, wife of the President of the company, acted as sponsor.

The Canadian Runner is a steel freight steamer for ocean service, length, 335 feet over all; beam, 44 feet; depth, 25 feet; of 4,400 deadweight tons, fitted with 'tween decks with poop bridge and forecastle.

This vessel is over canal size and will be cut at Buffalo and taken through the Welland and St. Lawrence canals in sections, and rejoined at Montreal or Quebec.

Boilers.—2 Scotch boilers, 15 x 11 feet., Howden force draught, designed for a working pressure of 180 pounds.

Propelling machinery consists of a triple expansion surface condensing engine, having cylinders 23-inches x 36-inches x 63-inches x 42-inches stroke, designed to develop from 1,750 to 2,000 horse power, and to give the vessel a speed of 11 knots.

The Port Arthur Shipbuilding Company, Limited, has under construction for the Department of Marine, the S. S. Canadian Carrier, a sister ship and similar in all respects to the S. S. Canadian Runner. The company expects to launch this boat in three weeks' time.

They have also under constructlon for the Department of Marine another ocean freighter of 3,900 deadweight tons, to be delivered this season.

DECKING MATERIAL

The steamship "Texan" lately had to have some of her deck removed in order to make repairs. This deck was covered with Asbestolith flooring which had been laid on the steel plates ten years before, and when the flooring was removed, the steel deck underneath was found to be in excellent condition. There was no sign of corrosion to be seen. The manufacturers of the composition had samples of the deck and flooring removed and have the same in their New York Offices.

CONCRETE BARGES

The following statements, made by Mr. Edward S. Walsh, Superintendent of Public Works, New York State, are interesting to those who are still hopeful of the merits of the concrete ship. Mr. Walsh states that the concrete barges built for the New York State Canal cost $13,000 more to build than wooden barges of the same dimensions, and also that they draw four feet of water when light. The best kind of boat for canal purposes, according to this authority, is the wooden barge, 150 feet long, drawing 18 inches of water when light, and eight feet loaded, with 18,500 bushels of wheat.

Vancouver.—The property owned by Mr. Alexander McLaren, the well-known lumberman, has been purchased by the A. Linton Company for $35,000, and the buildings now used by J. R. Van Dyke & Sons, situated on the property were bought for $5,000. Mr. A. Linton is one of the pioneer boat builders of the Province, and founded his business in 1884. He has built between ten and eleven thousand boats and launches in that time. The property just acquired will be used in the building of boats, after suitable alterations have been made. It is expected that about six months will be required for this purpose before actual building is commenced.

Orders for Steel.—Important developments are expected from a survey which is now being made of the iron ore area at Lock Lomond and at other parts of Cape Breton. The examination is being made by a geological expert in the employ of the Dominion Steel Corporation. The Armstrong Whitworth Company, one of the largest shipbuilding firms in Great Britain, has been endeavoring to place an order for 20,000 tons of ship plate with the Dominion Steel Corporation here. The Government of New South Wales has also been negotiating for 15,000 tons with the Dominion Government. A total of 19,000 additional tons have been sold to other Governments.

D. C. Tennant has been appointed designing engineer for the Dominion Bridge Company at Lachine, and will be assistant to F. P. Shearwood, who is in charge of all the erection schemes of the company.

MARINE ENGINEERING

AND

Canadian Merchant Service Guild Review

A monthly journal dealing with the progress and development of Merchant and Naval Marine Engineering, Shipbuilding, the building of Harbors and Docks, and containing a record of the latest and best practice throughout the Sea-going World.

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MARINE ENGINEERING PROGRESS

THE recent meeting of the Institution of naval Architects was productive of some very interesting papers on a variety of subjects connected with the shipbuilding and marine engineering profession. The papers read covered a wide range of subjects, and give to the reader a very good idea of the progress made in these two sciences in late years. The description of the stabilising of ships by means of gyroscopes, reprinted in this issue of Marine Engineering of Canada, shows that this very desirable object has at least been brought within practicable reach. The immense benefits which would accrue to the travelling public from a device of this kind, if generally adopted in passenger carrying vessels, need no emphasis. There are thousands of people desirous of taking journeys involving a sea voyage who put their fear of seasickness before the pleasures to be derived. The elimination of rolling would make this popularity of sea travel one hundred fold greater than it already is. This, of course, is only one feature of ship stabilising. The saving of time on a long voyage would be considerable, and the risk of damage to ship and cargo from heavy seas would also be greatly lessened. The engineer on watch would not be the least appreciative of the added comfort. Bad weather at sea is nobody's friend, but it adds an extra share of difficulties to the men who have to walk around on slippery gratings in the engine room, and those who have to wrestle with heavy firing tools in the fire-hold. The future development of the gyroscope will be watched with keen interest by all those interested in the affairs of the sea.

Another paper of great interest was read by Engineer-Commander H. B. Tostevin, who took for his subject the development of mechanical reduction gears in the British Navy. The author traces the adoption of the geared turbine from Sir Charles Parson's first experiment with the "Vespasian," and the Admiralty's trial of the system in 1910, when reduction gears were fitted on two destroyers, up to the fitting of gears transmitting 36,000 shaft-horse-power in the largest battle cruisers. He goes into the questions of actual operating experience, and the defects discovered, and also methods of manufacture.

It is significant that the Admiralty have pinned their faith to the mechanical reduction gear. The electric drive, which has been so much heralded on this side of the Atlantic, does not seem to fulfill their requirements. The mechanical reduction gear appears to give the advantages of reliability, simplicity of construction, and high mechanical efficiency which sufficiently outweigh those claimed for the electric or hydraulic reduction gear.

The necessity of obtaining true dynamic balance in rapidly revolving machines such as turbines, and in propellers to eliminate vibration, is well known. A method of balancing motors, and determing the position and amount of the balancing weights required is described in a paper by J. J. King-Salter, R.C.N.C. The machine described was used at the Commonwealth Dockyard, Cockatoo Island, Sydney, N.S.W., and the various tests were carried out by the author of the paper, who also devised the machine itself. The results obtained are of far reaching importance, and the author claims for this method that it places the balancing of motors in a sphere of precision which it did not reach before.

These examples out of the many papers show how we are progressing, little by little, to the day when we shall achieve perfection. This will not come in the life-time of any of us here to-day, but it is quite conceivable that it will come eventually. When the triple expansion engine was perfected, people thought that the limit of achievement had arrived. The turbine seemed to be, later on, the very last word. Then came the single reduction gear, and afterwards the double reduction gear. The progress was not left alone to the builders of motive power. Hull designers were busy, as the advent of the Isherwood type showed, and further modifications which have been adopted since that date. In the design of warships hull, the most far-reaching development is that of the blister, designed to make the vessel torpedo proof. It is truly an interesting age to be living in, and one wonders, when the mail brings the reports of the transactions of various engineering societies, what new achievement in the field of engineering or shipbuilding has occurred since the last meeting.

LLOYD'S LATEST FIGURES

THE latest returns of Lloyd's Register of Shipping provide interesting and instructive reading to those who care to examine them carefully. The outstanding feature is of course the great increase in ships building in the United Kingdom, and the great decrease in ships building in the United States. The tonnage building in the U.K. at the end of March of this year is 400,000 tons greater than the tonnage under construction at the end of last year, while the tonnage for the same period in the United States shows a decrease of 393,000 tons from the total at December 31st. There was under construction in the world at March 31st, 7,941,950 tons, an increase of 81,000 tons over the last quarter. It is interesting to note that at the end of March, 1914, the total construction in the world was 3,343,154 tons, or less than half that of the present day. It is like-wise good to see that the Society of Lloyds have under their supervision with a view to classification no less than 4,965,612 tons, which is a an increase of 150 per cent. over the same period in 1914. It would appear from these figures that Great Britain was in no immediate danger of being eliminated from the shipbuilding field, and that Lloyd's Register is still the leading classification society.

The Story of Trinity House and Its Associations

An Interesting Paper Read Before the Members of the London and Middlesex Archaeological Society.

THERE are four societies of mariners in this kingdom, which are called Trinity Houses, viz., Deptford, Newcastle, Hull and Dover. Deptford is the body corporate of the Shipmen and Mariners of the whole realm; Newcastle and Hull of the mariners of those ports. Dover is not a corporation but only a court of loadsmanage, acting by commission from the Lord Warden of the Cinque Ports.

The several bodies in earlier times came into disputes as to their respective rights, "but they have lived in a peaceable neglect of each other for the most part."

At Leith there is also a Trinity House, founded by Henry & Mary, King and Queen of Scotland, for pensions for mariners; one of its functions is to administer this charity. It is also a pilotage authority.

The London Trinity House was first established at Deptford; its hall stood with the almshouses on ground given by Sir Richard Browne, of Sayes Court, Master in 1672. The hall was left when the almshouses were demolished in 1873, and it is now known as the Trinity Temperance Hall, but has no connection with Trinity House. The inmates of the Deptford Almshouses were removed to the Mile End Houses. These were visited by our society recently, and the charm of Wren's domestic architecture must be fresh in all our memories. There were houses at Stepney, for dinners are recorded there, and Ratcliffe was visited in 1618.

The new Trinity House in the city at Water Lane, Great Tower Street, appears in the accounts for the removal to it of a chest with five locks on March 2, 1660-1. This building was burnt down in the Great Fire of 1666. It was rebuilt 1671, and was described by Hatton as "a stately building of brick and stone, adorned with 10 bustos." This also, in 1714, was destroyed by fire. Rebuilt in 1718, it was superseded by the house in which we are assembled. The abandoned building remained and was occupied as offices and known as Old Trinity House, a stone dated 1718 being inside its courtyard. This stone has been preserved and may be seen in the entrance hall of the modern offices erected on the site some time in the latter half of last century. The present Trinity House on Tower Hill was designed by Samuel Wyatt, and the foundation stone was laid by William Pitt, the Master, on September 12, 1793, the building being completed in 1798. Over the windows are medallions with portraits in low relief of George III. and Queen Charlotte, and representations of lighthouses and emblematic devices.

Statutes and Ordinances

The statutes and ordinances of the Guild Fraternity, or Brotherhood of the Most Glorious and Undivided Trinity and St. Clement, in the parish of Deptford Stroud, are so like to those of the city guilds that were voluntary bodies (in some cases for centuries) before they obtained charters, that we are justified in believing that they arose in a manner similar to theirs. The most laudable object of any body of men, united in the bonds of a common occupation, is to provide for its sick and infirm members and to join in the services for the solemn burial of its dead.

The adoption of St. Clement in conjunction with the Holy Trinity may give a clue to the original home of the guild; at Leigh-on-Sea, in the Estuary of the Thames, where many mariners lived on the banks of the river, and had a station for pilots to bring vessels up the river, the church is dedicated to St. Clement, and in it are monuments to departed Trinity brethren. Leland writes of Deptford:

"Depeford or Deptford was only a village of fishermen a few years ago. Henry VIII., the ornament of all princes, built a dock here for the conservation and repair of ships and built a storehouse for arms near it." To be in touch with the dockyard the Trinity pilots established themselves there, and having become useful to the Royal Navy in supervising the building and outfitting of vessels, and later on in victualling them, their guild (by prescription) received its first Charter from Henry VIII., in which the dedication to the Trinity and St. Clement was simply continued and not inserted for purposes of superstition, as that staunch Protestant historian of the guild, John Whormby, boldly asserts. We owe much to John Whormby as we shall note later on.

Henry VIII.'s charter reads: "May of new begin, erect, create, ordain, found, unite and establish a certain guild." He nominated Sir Thomas Spert as first Master; he lies buried and has his monument at St. Dunstan's, Stepney.

This charter provided for brethren and sisters. The advancing in status of a voluntary body has recently occurred. The Institute of Shipbrokers, actively working in the interests of that profession, and having justified its existence for the public good, has been granted a charter of incorporation—a rare privilege, there having been only some twenty of such grants during the last century.

The principal charters held by the guild are from Henry VIII., Elizabeth, Charles II., and James II. Under Edward VI. the title of the guild was changed to "The Corporation of Trinity House," to avoid possible spoliation due to its dedication to the Holy Trinity and St. Clement. With the charter of James II., Samuel Pepys was actively engaged; his connection with the navy and the King, when Duke of York, as also the Earl of Sandwich, enabled him to promote the interests of the House. It is a lengthy document, and its engrossment occupied so much time that the Master's election day was postponed for some days to allow of its being read in due form on his installation as master.

Pepys' pride in his share in this charter led him to have it printed; an assumed flaw in the reference to ballastage induced an adventurer to dredge for ballast in defiance of the Trinity House rights, and was the cause of lengthy litigation. During the Commonwealth the charters were dissolved, and the affairs of the House placed in commission, Roundheads, of course, being in the majority.

The records of the House are very defective; they were mainly lost in the Great Fire of 1666 at the Trinity House in Water Lane, and in 1714 at the same place, "although Mr. Noyes sacrificed his own goods to the preservation of the corporation's books."

Pepys, ascending the Tower of All Hallows, Barking, records how he saw the fire from Trinity House on one side to the Dolphin Inn, Seething Lane, on the other. The records suffered much from careless keeping.

A collector of Records

The recovery of many that had gone astray was due to that devoted secretary in 1746 of this house, John Whormby. While collector of light dues (to use his own words) "the curiosity and opportunity" to trace them, and also to gather and store such facts that he came across. He records in his account of the corporation, "that, having heard of Mr. Pepys' famous library of naval tracts at Magdalene College, Cambridge, and knowing how active and useful a gentleman he had been in the affairs of the corporation, I had a strong curiosity to inspect them."

He made extracts and bespoke copies, "but as the college is to forfeit the whole library if they lose a single book they would not suffer any but their own scholars to make out those copies, so they were made out by their scholars and sent up to me in loose sheets, which I bound together and entitled 'Pepysiana,' by which name I refer to the book." When Mr. Pepys left the office (on refusing the oaths) at the Revolution, he carried away several of the office books with him (as I am informed), though since recovered.

Whormby was an indefatigable searcher. At the Privy Council, the Navy Office, the Record Office, and the Admiralty, he enlisted the help of Mr. George Holmes, Keeper of the Records in the Tower, and awakened an enthusiasm in the search equal to his own.

Whormby found among the books at the office "a small venerable vellum book of great antiquity, which contains translations of Charles, Henry VIII.'s and Elizabeth's Charters, used in evidence in the Court of Exchequer, so that it ought to be carefully preserved, and therefore I keep it locked up." He expresses great indignation at Captain Crisp's "notes and crossings" in this beautiful book.

Writing on the charter of James II., Whormby says: "Here I shall only farther observe upon this charter, that the enrolment of it was neglected in its course, and until of late years, nor doth it seem to have been mended by the corporation, though they were reminded thereof soon after the Revolution, by the objections which were raised thereon by the Council for Emboskye in the cause about Trinity House duties.

"This was a defect which I never apprehended nor understood the hazards of until 1727, when the Gentlemen of the Rolls (where I had been long familiar), who were curious in looking into everything in my way, and for my information, took notice of it to me, and apprized me of those hazards, namely, that if the original charter should be lost, or the seal thereof so far gone as not to have a distinguishable impression, that loss could not be any otherwise supplied than from the rolls; so that the authority of that charter would be entirely destroyed; and as the corporation had acted under it so long, their constitution might have been affected thereby.

"At this I was much startled, and the more so when I came to look at the bad condition of the seal, which (however) I so far secured by a case that it is now as entire as it was then. Then I consulted with those gentlemen how to supply that dangerous defect, who told me that it could only be done by a petition to the Master of the Rolls to have it enrolled, which they said had sometimes been done.

"But it happened unluckily just at that time that Sir Jos. Jekyl (naturally scrupulous and newly come to that office) had rejected some applications of that kind (one in particular wherein the Prince of Wales was concerned); so they advised our waiting a proper opportunity, which they promised to watch.

"Thus we waited above ten years, until his honor's stiffness abated by degrees, on considering that the enrolment of a grant doth not add to its strength, but is only an evidence (although the only evidence which the law allows where an original is lost) that there was such a grant under the Great Seal. But when Mr. Rooke found him pretty easy thereon (particularly in a case of the New River Company), the corporation was acquainted therewith, who left this affair to Mr. Rooke, and he obtained his honor's order of 12th May, 1738, for the enrolment of this charter of 1685, which he enrolled accordingly; and that enrolment is as good, to all intents and purposes, as if it had been made in 1685.

"The occasion of its not being enrolled was not through any possible objection to the charter itself, but by its falling into the bad company of many ill charters of that reign, and perhaps the words of the Proclamation might affect it as well as others."

The cash books were divided into lunar months, and so had double months until 1676.

Privileges and Duties

At one time the Trinity Brethren were the right-hand of the Royal Navy, controlling the design of ships, certifying them before they were put in commission, victualling them, examining officers in navigation, besides their primary duty of training, and supplying pilots for the navy and mercantile marine and appointing consuls abroad. They had rights of ballastage, which grew out of the necessity of keeping the channels of the river at a sufficient depth for navigation. They were the official measurers of ships for tonnage, a duty now discharged by his Majesty's Customs. They held the main stations for lighthouses, were responsible for buoyage of channels and the erection of beacons, and they had certain control of the River Thames as to obstructions to navigation. They were bound to provide for the defence of the river from enemy attacks by service of men and provision of vessels; it was in recognition of this that James II. granted all Trinity men exemption from land service and juries. They were to examine the mathematical scholars at Christ's Hospital.

By various Acts of Parliament, many of these duties have been transferred to other bodies. The brethren have no control of the Thames, the Royal Navy has its own architects and victualling department, but the Trinity House is now the general lighthouse authority for England and Wales, and is responsible for lights, beacons, and buoys; it licenses pilots and administers its estates for the relief of mariners, and it continues a duty and privilege not mentioned before —the assisting in the Admiralty Court by Elder Brothers sitting as assessors with the judge.

There is an inscription in the Beauchamp tower in the Tower of London by one T. Salmon, of whom Mr. Dick, in his account of the Tower, says nothing is known; but the device of three salmon in triangle and the sculptor's name and the date 1622 lead me to look for a relationship with the Salmons of this house, and to the conjecture that some unadjusted accounts for victualling the Royal Navy led to "Thos. Salmon sojourning as close prisoner for 8 monethes, 32 weeks, 224 dayes, 5,370 houres" in that fortress.

"The corporation," states Whormby, "have no limited number of Younger Brethren, nor do their charters confine them thereto. A limitation hath been sometimes proposed among themselves, and in 1682 was endeavored by the lieutenancy of the Tower Hamlets, where 140 of the 363 Younger Brethren lived; but this corporation would never come into it, and it was always opposed by Mr. Pepys in particular. It was urged by him and others that their numbers

could not be too great, that mariners are a strength of the nation, that every one had a right to be a brother, and that if there were 4,000, or if all were brothers, it would be much more for the King's service than when they were not 400."

Elections and Dinners

The election of the Master is the great day of the house on Trinity Monday, and follows the lines of the guilds of the City of London—election, church, and dinner. We learn much of these from Pepys and Evelyn.

Samuel Pepys was sworn a Younger Brother on February 15, 1661/2, his patron the Earl of Sandwich, being Master. On June 15, 1663, he records of the election of Sir William Batten as Master, "found them reading their charter, which they did like fools, only reading here and there a bit, whereas they ought to do it all every bit." Pepys was Master for the first time in 1676, and for the second on July 20, 1685, and was named as first Master in the charter referred to by John Evelyn on that day.

Evelyn records on July 20, 1685: "The Trinity Company met this day, which should have been on ye Monday after Trinity, but was put off by reason of the Royal Charter being so large that is could not be ready before. Some immunities were superadded. Mr. Pepys, Secretary to ye Admiralty, was a second time chosen Master. There were present the Duke of Grafton, Lord Dartmouth, Master of ye Ordnance, the Commissioners of ye Navy, and Brethren of the Corporation. We went to church according to costome, and then took barge to the Trinity House, in London, where we had a great dinner, above 80 at one table."

Evelyn was sworn a Younger Brother on March 26, 1673, Sir Richard Browne being Master for the year.

At the present day the elections take place here, and then the Master and Brethren proceed on foot to the church of St. Olave, Hart Street, and return to dine.

Pepys records of Trinity House dinners are very plain-spoken:

January, 1662.—After the Trinity men had done their business, the Master, Sir William Rider, came to bid us welcome; and so to dinner, where good cheer and discourse, but I eat a little too much beef, etc.

September, 1662.—At Whitehall. There Sir John Minnes, both Sir William and I to the Trinity House, where we had at dinner a couple of venison pasties, of which I eat but little, being almost cloyed, having been at five pasties in three days, namely, two at our own feast and one yesterday and two to-day.

November, 1662.—To Trinity House to a great dinner there by invitation and much company. It seems one Captain Evans makes his Elder Brother dinner to-day.

At Tower dining, "and so went away a second time like fools."

Pepys is not very complimentary to his co-guests at times—as:

"To Trinity House, and there I dined among the old dull fellows"; or, "To Trinity House, where a very good dinner among the old jokers"; or, again, "A very poor sorry dinner"; but, better, "Great dinner of Captain Crisp, Elder Brother, and so being very pleasant at dinner away home."

An Election Nearly 100 Years Ago

Hone has given an interesting account of an election at Deptford.

"This Maritime Corporation, according to their Charter, meet annually, on Trinity Monday, in their hospital for decayed sea-commanders and their widows, at Deptford, to choose and swear in a Master and Wardens and other officers for the year ensuing. The importance of this institution to the naval interests of the country, and the active duties required of its members, are of great magnitude, and hence the Master has usually been a nobleman of distinguished rank and statesmanlike qualities, and his associates are always experienced naval officers; of late years Lord Liverpool has been Master. The ceremony in 1825 was thus conducted:

"The outer gates of the hospital were closed against strangers, and kept by a party of hospital inhabitants, no person being allowed entrance without express permission. By this means the large and pleasant courtyard formed by the quadrangle afforded ample accommodation to ladies and other respectable persons. In the meantime, the hall on the east side was under preparation within, and the door strictly guarded by constables, stationed without; an assemblage of well-dressed females and their friends, agreeably diversified the lawn. From 11 until 12 o'clock parties of two or three were so fortunate as to find favor in the eyes of Mr. Snaggs, the gentleman who conducted the arrangements, and gained entrance. The hall is a spacious handsome room, wherein divine service is performed twice a week, and public business, as on this occasion, transacted within a space somewhat elevated, and railed off by balustrades. On getting within the doors, the eye is struck by the unexpected appearance of the boarded floor; it was strewed with green rushes, the use of which by our ancestors, who lived before floors were in existence, is well known.

"The reason for continuing the practice here was not so apparent as the look itself was pleasant, by bringing the simple manners of other times to recollection. At about one o'clock, the sound of music having announced that Lord Liverpool and his associate Brethren had arrived within the outer gate, the hall doors were thrown open, and the procession entered. His Lordship wore the Star of the Garter on a plain blue coat, with scarlet collar and cuffs, which dress being the Windsor uniform, was also worn by the other gentlemen. They were preceded by the Rev. Dr. Spry, late of Birmingham, now of Langham Church, Portland Place, in full canonicals.

"After taking their seats at the great table within the balustrades, it was proclaimed, that, this being Trinity Monday, and therefore, according to the Charter, the day for electing the Master, Deputy Master, and Elder Brethren of the Holy and Undivided Trinity, the Brethren were required to proceed to the election. Lord Liverpool, being thereupon nominated Master, was elected by a show of hands, as were his coadjutors in like manner. The election concluded, large silver and silver-gilt cups, richly embossed and chased, filled with cool drink, were handed round; and the doors being thrown open and the anxious expectants outside allowed to enter, the hall was presently filled and a merry scene ensued. Large baskets filled with biscuits were laid on the table before the Brethren. Lord Liverpool then rose, and, throwing a biscuit into the middle of the hall, his example was followed by the rest of the Brethren. Shouts of laughter arose, and a general scramble took place. This scene continued about ten minutes, successive baskets being brought in and thrown among the assembly, until such as chose to join in the scramble were supplied. The banner bearers of the Trinity House, in their rich scarlet dresses and badges, who had accompanied the procession into the hall, increased the merriment by their superior activity. A procession was afterwards formed, as before, to old Deptford Church, where divine service was performed, and Dr. Spry being appointed to preach before the Brethren, he delivered a sermon from Psalm CXLV. 9, "The Lord is good to all, and his mercies are over all his works." The discourse being ended, the Master and Brethren returned in procession to their State barges, which lay at the stairs of Messrs. Gordon & Co., anchorsmiths. They were then rowed back to the Tower, where they had embarked, in order to return to the Trinity House, from whence they had set out. Most of the vessels in the river hoisted their colors in honor of the Corporation, and salutes were fired from different parts on shore. The Trinity yacht which lay off St. George's, Deptford, was completely hung with the colors of all nations, and presented a beautiful appearance.

"Indeed, the whole scene was very delightful and created high feelings in those who recollected that to the Brethren of the Trinity are confided some of the highest functions that are exercised for the protection of life and property on our coasts and seas."

Lights and Beacons

Those who make only a short trip to the Continnt by direct steamer from London can see much of the Trinity House work as to lights, beacons and buoys, and to them many of the models to be seen here will have familiar features.

Starting from the Pool, we see the large moorings buoys that are under the control of the Port of London Authority, but as soon as we get into the lower reaches of the river we begin to pick up the navigation buoys, such as we have seen in passing, lying on Trinity Wharf, Blackwall.

We see our first beacon (a skeleton

iron tower) as we enter St. Clement Reach, on Broadness, a very dangerous point, especially during fog—the steep and dangerous Blackshelf on the north side of the river on which the tide sets strongly both on the flood and ebb. I have seen vessels well up in the field on the south shore by the beacon.

Passing Gravesend, we see our first lighthouses, the Mucking and the Chapman, and further east the Nore Lightvessel, and open out the Mouse and Girdler Lightships.

We look across the Kentish flats and learn why Trinity House preserves at great expense the two western towers at Reculver, and bore the cost of some £2000 for the tower of Trinity Church, Margate, and replaced windmills that had gone out of use by lofty columns of colored brickwork. If it be night, we note variations as to the lights from the lighthouses, the duration and alternation of illumination and eclipse.

Still further east we pass the Girdler, Princes and Tongue. At the latter spot we come into the rotating light of the North Foreland, and presently run into a section of its ruddy warning light and know that we shall soon change our course if bound for France, and then further south meet the Pilot boats awaiting vessels from oversea. Here, if it be foggy—that great danger for seamen—is brought into action the fog-horn of great power, each station giving a different series of blasts. At Dover is the oldest lighthouse in the kingdom, the Pharos, in the Castle.

The first warning coast lights were probably open fires on hillsides; then coal and wood fires in iron cages on church towers or other high buildings. The Lizard was lighted by coal up to 1812. Progress in illumination has been continuously sought by the use of different combustibles. The Eddystone Lighthouse (of which pictures are in the inner corridor downstairs, being Winstanley's fantastic design of 1691, Rudyerd's wooden tower of 1709, and Smeaton's fine erection, showing one of its stumps alongside its successor) was lighted with 24 candles up to the year 1811. Two of these candles are in a case outside this room, and the clock with its bell that struck each half-hour to call the keeper to snuff the candles.
The next advance was by the use of oil lamps. That at Bidstone had a 12-in. wick. Then came the Argand oil burner, and long experiments to test the penetrative power of gas and electric light. At present vaporised oil is used with a mantle, in the same way as with gas in some houses.

With the improvement of illumination great progress has been made with the reflectors and lenses used to concentrate the light. Each light has its distinctive character—stationary, intermittent, revolving, plain or colored beams and varieties in lenses. The act of light from each lighthouse touches that of its neighbor, so that the whole of the coatline of these Islands is belted with light, to the security of the mariner by night, as by the sea marks by day.

SHIPBREAKING AND OBSOLETE WARSHIPS

It was Longfellow who wrote:

"Build me straight, O Worthy Master
Staunch and strong, a goodly vessel
That shall laugh at all disaster
And with wave and whirlwind wrestle.
"Broad in the beam that the stress of the blast
Pressing down upon sail and mast
Might not the sharp bows overwhelm;
Broad in the beam, but sloping aft
With graceful curve and slow degrees
That she might be docile to the helm,
And that the currents of parted seas
Closing behind with mighty force,
Might aid and not impede her course."

These and the remaining lines of his beautiful poem, commemorate the birth of one of man's finest handiworks; and although several equally well-known poets have put into verse the passing of many such goodly ships after unsuccessful battles with the forces of nature, none of them, so far as the present writer is aware, have similarly immortalized the dismemberment of other goodly ships after passing into the hands of the shipbreaker. Sad as it is to call to mind, the loss of a ship at sea, such as that immortalized by Longellow in the "Wreck of the Hesperus," or any other case not so treated by poets, the comparatively ignominious end of many a fine ship (that has served her country well) through the medium of the shipbreaker is almost equally mournful.

At the moment many warships are now being turned into "scrap," their useful life having been completed, and if one made a tour of some of the districts where shipbreaking is a recognized industry, one would probably find many a hole and corner where such vessels are passing into oblivion. Blythe, the Tyne, and Mersey have at various times received obsolete vessels that have never left those places again except in pieces on a railway truck or the hold of a tramp steamer, besides many little seaports where one would scarcely have expected to find shipbreaking in progress. Thus, in the small seaport town of Gosport one might espy, alongside an obscure quay, two or three of the original type of torpedo boats in various stages of dismemberment.

The industry of shipbreaking has undergone almost a complete transformation with the introduction of the oxy-acetylene cutting process, for whereas the older method of breaking up a vessel by cutting out individual rivets was a long and laborious one, the amount of destructive work that can be done in a day by a skilled operator with the burning process is most startling. The oxy-acetylene flame, as perfected in the modern apparatus now in universal use, plays an important part in many industries, notably in that of building ships, but it is doubtful whether it has ever been used to more effective purpose than when applied to the work of breaking up old ships. Skilled workers can, it is believed, earn up to £8 or £10 per week and from the amount of work they can get through in the course of an ordinary day it certainly appears that they are worth it.

The writer is not aware of how long shipbreaking has existed as a commercial proposition, but it needs no mighty intellect to realize that it requires a very astute man to be able to judge what profits are likely to acrue from any particular deal. Thus, take a typical example of the purchase of an obsolete warship for breaking up. The vessel will probably be purchased as she stands at a naval port such as Chatham; from thence she must be towed to the port where the purchaser proposes to break her up. It may be a continental one, but as one of the conditions of sale is frequently that of being broken up at a United Kingdom port, it is more likely that she must be towed to a specified port in Great Britain. It is unlikely that she will be able to go round under her own steam, as, in addition to the cost of putting her into a fit condition for propelling herself, a vessel capable of using her engines and boilers is not usually found among the "lots for sale," although this may happen occasionally. When he has got her alongside the berth where he proposes to dismember her, he has got to provide special facilities for removing the scrap and various fixtures so that their presence shall not interfere with the progress on the remaining portion. This in itself is a very important consideration for the shipbreaker.

Before fixing a price at which he is likely to see a profit, he must be able to get a very fair idea of the value of stores, furniture and other fittings for which he will be able to find a market when removed bodily from the ship. This although probably not a very easy matter for any "outsider," does not, as a rule, prove difficult to the experienced man, who knows exactly where he is likely to find his market, and pretty well what they are likely to fetch. A complete set of engines, of instance, in good condition, might at first sight appear to command a good price, but their revolutions, power, consumption, space occupied, etc., all have to be taken into consideration before it is possible to say whether they are likely to find a bidder for them as a "going concern." As often as not, one of these features is totally unsuitable for any commercial job, when the realizable value of the set is not much more than its value as scrap; in all cases they are likely to be of an old pattern, probably uneconomical, and therefore unlikely to find a ready purchaser.

A large number of war vessels on the effective list in the early part of 1914 were nearing obsolescence and would, in the ordinary course of events have been scrapped within a few months from August of that year. There were also a large number that would have become obsolete between that date and the end of 1918; but in view of the necessity for

employing every vessel of war that could hold together and propel herself during the submarine campaign, practically no vessels coming within the above two categories were actually scrapped.

Since the end of hostilities, however, all these obsolete vessels have been gradually passing to the sale list, and a number of them are already sold, so that there are now plenty of them in the shipbreakers' hands, and, as stated earlier in this article, a visit to any of the localities where shipbreaking is a recognized industry would confirm this. Now, if ever, is the time for inspiration of another Longfellow who will put into verse the gradual disappearance of a "goodly vessel that has already laughed at all disaster and with wave and whirlwind has wrestled."

*Liverpool Journal of Commerce.

ADMIRALTY COURT REPORT

Re S. S. "Canadian Voyageur"-Schr. "Howard D Troop"

In the matter of a formal investigation held in the Board of Trade Council Room, St. John, N. B., on April 22nd and 23rd, 1920, before Captain J. Blanchard Henry, Commissioner, assisted by Captain A. J. Mulcahy and Capt. Samuel Orr, acting as nautical assessors, into the cause which led to the collision between the S. S. "Canadian Voyageur" and the St. John pilot schooner "Howard D Troop," in the Bay of Fundy, on April 17th, at about 9.30 p. m., resulting in the loss of the latter vessel.

Mr. F. R. Taylir, K. C., appeared on behalf of the St. John Pilto Commissioners, and Mr. Edward C. Weyman for the master and owners of the S. S. "Canadian Voyageur."

The evidence from the schooner was to the effect that the "Howard D Troop' was schooner rigged, with a 60 horse power auxiliary Wolverine engine, capable of driving her at 7 knots, built in 1896, of 69.15 tons, being 85 feet in length with 22 feet beam; that at the time of sighting the steamer there were on board four licensed pilots and three apprentices.

The schooner sighted the lights of the steamer about 9 p. m., April 17th, weather being dark and clear, with a strong breeze about east, and moderately heavy sea, the schooner at the time running down the south channel between Petit Passage and Grand Manan. The usual blue fare was exhibited, and answered by the steamer, and as vessels approach ed the steamer's head veered to northward and eastward, showing all three lights, also a lantern or port side to indicate ladder.

Just when the small pilot boat was leaving the schooner the steamer's head veered to southward then making the starboard the lee side, and the boat rowed around the stern of the steamer to that side. The schooner then ran down across the steamer's bow about half a mile, under sail only, to be in readiness to pick up the pilot boat. When she tacked ship she was about abeam, or a little abaft of the steamer's beam.

After tacking ship the helm was put down to prepare for picking up small boat; but it was later noticed the steamer was not doing as expected, viz., going ahead. The helm was then put up to get weigh on the schooner, and the main sheet was let go so she would pay off and fill, and Captain McKelvey, who was in charge of the schooner, ran below to start the gasoline engine, the apprentice who usually attends the engine being away in small boat, though there was another apprentice on board the schooner, and succeeded in his first attempt in throwing the clutch over full speed ahead; but the engine was not going long enough to have an effect on the ship before the collision.

The steamer drifted rapidly down on the schooner, the latter being in the lee of the steamer and therefore not feeling the effect of the breeze on her sails.

The evidence on behalf of the steamer showed that the S. S. "Canadian Voyageur" is a single screw vessel, with triple expansion engines, of 1,868 tons net, built over a year ago, of 320 feet length, 42 feet beam, drawing 13 feet 6 inches aft and 12 feet forward, carrying a crew of 38 all told, registered at Montreal, Official No. 140,957; that she left London on the 2nd of April, 1920, bound for St. John, rounding Cape Sable on April 17th, after an uneventful voyage.

At 9.15 p. m., April 17th sighted pilot boat lights when Petit Passage Light was nearly abeam. The night was dark, but clear, with a fresh breeze blowing about E.N.E., striking the ship on bluff of port bow. After answering pilot flare the master stopped the engines when the pilot vessel was about a point on the port bow, the helm having been put hard aport, and the ship falling down to the southward and eastward with the wind on the port bow. When the ship had fully stopped the pilot boat was about four points on the port bow, the small boat being apparently lowered at this time, and came around the stern to the lee side. The pilot schooner was sailing down across the steamer's bow when the pilot came alongside. Pilot Spears, who boarded the ship, proceeded to the bridge and ordered full speed ahead; the telegraph being moved accordingly; but the answer came from the engine room stop. The master left the bridge, running down to the engine room, leaving only the pilot on the bridge, to ascertain how long it would be before the engine would be in readiness to proceed, notwithstanding the fact that there was a speaking tube from the bridge to engine room, and was advised it would take a minute or two. The master returned to the bridge after an absence which he estimated at two minutes, and found the pilot vessel was then about 30 or 40 feet from the ship's side, heading at an angle of about 45 degrees from the starboard beam. About two minutes after the master returned to the bridge he received a signal from the engine room that everything was alright; but it was then too late. The schooner's jib boom struck the steamer a glancing blow, with an angle forward, and the ships came broadside to, the pilot vessel pounding against the ship's side for some few minutes. Different engine orders were given in an endeavor to clear the vessels without success until it was found necessary to abandon the schooner owing to damage done, and when the pilots had left their vessel, with the help of the engines the vessels parted and the schooner sailed away. The pilots and apprentices were picked up as well as their boat, and a search made for the schooner; but she disappeared, and the steamer proceeded to St. John about midnight without further trouble.

Finding

After carefully reviewing the evidence adduced the court finds that the Steamer "Canadian Voyageur" was for the moment, after boarding the pilot, unable to proceed under the orders from the bridge owing to the engines being choked, and not responding as quickly as the occasion demanded, and when, after about five minutes delay, she was prepared, the ships had come together, the pilot vessel pounding along side near the quarter, and those on board the schooner requested that the engines be not moved, apparently for fear of fouling the steamer's propeller.

The court is of the opinnion that the master should not have left his bridge without a competent officer in charge. He ignored his speaking tube at a time when it was of vital importance that he should remain on the bridge and make signals to the pilot boat that his vessel was temporarily out of control.

The Court is further of opinion that those in charge of the Pilot Vessel "Howard D Troop" did not make sufficient allowance for the lee drift of the steamer, taking into consideration the conditions of the wind, trim of the steamer and the schooner's position when she hove to, according to the ordinary practice of seamen.

The Court finds that Captain McKelvey adopted a wrong manoeuver in putting his auxiliary engine full speed ahead instead of astern, away from danger, at a critical time; also that the man who attends the engine of the schooner was away on the small boat, and that Captain McKelvey did leave the wheel to operate the engine of the schooner himself at this time.

The Court is of the opinion that everything was done in the engineroom of the steamer that the occasion required, and that the evidence of the chief engineer, W. G. Beaver, was given in a clear, straightforward manner.

The Court finds that both Captain J. D. MacKenzie, of the steamer "Canadian Voyageur," and Captain Fenwick McKelvey, of the St. John Pilot Schooner "Howard D Troop," committed similar errors, namely, in leaving their decks when their duties were to overcome the accident.

The Court further finds that for the

above mentioned reasons both parties contributed to the collision.

The Court cautions both Captain MacKenzie and Captain McKelvey with respect to leaving their bridge, even temporarily, without a competent person in charge.

Read in open Court at St. John, N. B., this 23rd day of April, 1920.

Signed: J. Blanchard Henry,
Commisioner.

We concur,

A. J. Mulcahy,
Sam'l Orr
Assessors.

CANADIAN MERCANTILE MARINE WAR MEDAL

I.

His Majesty the King has been graciously pleased to signify his pleasure that the British war medal which has been granted to His Majesty's forces be granted also to the Dominion Mercantile Marine.

The silver medal will be given to those who can supply such evidence as may be approved by the Minister of Marine and Fisheries, of having served at sea for not less than six months between August, 1914, and November 11, 1918, inclusive

Those entitled to receive it will include crews of the Canadian Government ships and Canadian mercantile marine.

II.

His Majesty the King has also been graciously pleased to signify his pleasure that a mercantile marine war medal be granted to persons specified in the previous paragraph who are qualified for the British War Medal and who, in addition, can supply such evidence as may be approved by the authority referred to in that paragraph of having served at sea at least one voyage through a danger zone means:

(a) A voyage on a ship which entertered or cleared a United Kingdom port, or a French port, or a Mediterranean port:

(b) Such other voyages in other parts of the world as shall be specified on a further notice.

The medal will be in bronze and the riband will be green and red arranged vertically with a narrow white line between them.

III.

The authority referred to in paragraphs I. and II. will determine whether any applicant is disqualified for the medals by reason of misconduct during the war.

IV.

Officers, men and women, referred to in this announcement, who, whilst serving at sea, were captured by the enemy or lost their lives through enemy action, or were precluded by disablement through enemy action from further service for one or both medals, will be deemed to have qualified.

V.

The medals earned by deceased officers, men and women, will be issued to legatees or next-of-kin entitled to receive them.

A FAMOUS MOTOR BOAT

At the recent motor boat exhibition in London, the most attractive exhibit was the famous coastal motor boat, C. M. B. 4 from the Baltic after many cruises, during which she passed through lines of forts and torpedoed the Bolshevik cruiser Oleg. This vessel is a skimover or hydroplane of the type invented before the war for sporting purposes. It attains a speed of 40 knots with full armament and crew. The show contained many British examples of small auxiliary motors which can be attached to rowing boats and other small craft. Some of these are installed on board and others are attached to the stern without structural alterations. One pattern, with an engine rated at 2 to 3 horse power, weighs only 60 lbs, complete with propellor and steering gear.

A NEW MOTOR LIFEBOAT

The work of the National Lifeboat Institution of Great Britain was largely held up during the war, but an extensive programme of boat-building has since been started. It includes a number of motor-propelled lifeboats, this type having proved its superiority. On one occasion a motor l'feboat travelled forty-four miles in a terrible storm and rescued fifty people from a vessel which four other lifeboats of the old type had tried in vain to reach. One of the latest motor lifeboats toi be put in commission has many interesting features. It is of the self-righting type and is driven by a 45 horse power petrol engine at a speed of about 8 knots. When a lifeboat capsiezes it is necessary to stop the engine, as otherwise the boat will steam off and leave its crew in the water. This condition is met by means of two contacts in an ebonite box with mercury, so arranged that when the boat is sailing normally the contacts are immersed in the mercury. When the boat capsizes, the mercury is emptied out into a little reservoir and breaks contact, stopping the engine. Elaborate "jacketing" is resorted to in order to prevent water getting into the engine. Both magneto and accumulator ignition are installed, and a hand pump is available as well as the force feed system of lubrication. These and other precautions are adopted in order to prevent breakdown.

INTERNATIONAL ICE OBSERVATION AN ICE PATROL SERVICE

For the purpose of carrying on the International Ice Observation and Ice Patrol Service provided for by the International Convention for the Safety of Life at Sea, London, 1913-14, the U. S. Coast Guard cutters Ossippee and Seneca have been detailed for the service.

The object of the Ice Patrol Service is to locate the icebergs and field ice nearest to the trans-Atlantic steamship lane. It will be the duty of patrol vessels to determine the southerly, easterly, and westerly limits of the ice, and to keep in touch with these fields as they move to the southward, in order that radio messages may be sent out daily, giving the whereabouts of the ice, particularly the ice that may be in the immediate vicinity of the regular trans-Atlantic steam lane. During the months of April, May, June, and as much longer as necessary, these two vessels will obtain fuel and other necessary supplies at Portland, Me., and Boston, Mass., respectively. They will alternate on patrol, making alternate cruises of about 15 days in the ice region; the 15 days to be exclusive of time occupied in going to and from base. The movements of the vessels will be so regulated that on the 15th day after reaching the ice region the vessel on patrol will be relieved by the second vessel, if possible, at which time the first vessel will proceed to base, replenish her coal supply, and return in time to relieve the other vessel at the end of the latter's 15-day cruise. It is important that the patrol be continuous, and the vessel on patlor will not leave her station until relieved by the other vessel unless it be absolutely necessary to do so.

Having located the ice, the patrol vessel will send the following daily radiograms. All time in radiograms will be in 75th meridian time.

(a) At 6 p.m. (75th meridian time) ice information will be sent broadcast for the benefit of vessels, using 600-meter wave length. This mesage will be sent three times, with an interval of two minutes between each.

(b) At 4 a.m. (75th meridian time) a radiogram will be sent to the Branch Hydrographic Office, New York city, through the nearest land radio stations, defining the ice danger zone, its southern limits, or other definite ice news. The telegraphic address of the Branch Hydrographic Office is "Hydrographic, New York."

(c) Ice information will be given at any time to any ship with which the patrol vessel can communicate.

Ice formation will be given in as plain, concise English as practicable, and will state in the following order:

(a) Ice (berg or field).
(b) Date.
(c) Time (75th meridian time).
(d) Latitude.
(e) Longitude.
(f) Other data as may be necessary.

While on this duty the patrol will endeavor by means of daily radio messages to keep ships at sea advised of the limits of the ice fields, etc.

The radio messages from the patrol ships will be given publicity immediately upon their receipt by the Branch Hydrographic Office, New York, and by the Hydrographic Office, Washington, D. C.

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MARINE NEWS FROM EVERY SOURCE

Collingwood.—The Canadian Government steamer "Canadian Observer" was successfully launched from the yard of the Collingwood Shipbuilding Co. early in the month. She makes the fifth vessel built in this yard to the order of the Canadian Government. The vessel will be completed and ready for delivery some time in June.

Kingston.—Early in the month successful trial trips were run by the steamer "Canadian Beaver," built at the Kingston yards of the Collingwood Shipbuilding Company. The "Canadian Beaver" is the largest vessel to be constructed in Kingston. She is of the 3,500-ton class, suitable for lake or ocean trade.

Victoria.—A party of shipbuilders left here recently to undertake a long journey, having for its object the completion of a ship. This is a vessel of 175 feet length, which will operate between Forth Smith and Peace River Landing. She was framed last year, and it is expected that she will be finished by October. The party go to Edmonton, thence to Peace River Landing, and finish their journey by a 900-mile voyage down the river in scows.

Kingston.—Salvage operations will be resumed on the steamer Keystone, sunk seven years ago off Scow Islanad, Chippewa Bay. Capt. William Leslie, who worked on the wreck till late last season is taking his wrecking apparatus and crew out again this season. The Keystone foundered after striking a rock while on a voyage to Montreal with 2,500 tons of coal.

Montreal.—A new line for the Lower St Lawrence and Newfoundland is being inaugurated by the Canada Steamship Lines this season and will include all points in the Gulf to Gaspe, Prince Edward Island, and Newfoundland. The first steamer on the route will be the ss. Eugenie, and another vessel will be put on shortly of the passenger and cargo type.

New York.—Charles M. Schwab revealed that the greatest of all battleships was being built for the United States Government. His announcement, made at a luncheon for the New York University Endowment Fund, disclosed plans of the Navy Department, hitherto secret. The monster warship, which is of the battle cruiser type, will cost $15,000,000 displace 65,000 tons, and be 105 feet wide. It is one of several of similar design and power planned by the Navy Department.

Cleveland.—A large number of freighters have not been started, and more will be dropped next week, as not all the steamers in commission will be able to get fuel. Shippers and vesselmen say the supply, which has been very short since the start, has been cut down, and the boats are waiting all along the line. Steamers are unable to get enough bunker coal to take them from one Lake Erie port to another. A number of ore and grain carriers are coming down and some will not be sent back until there is a better supply of fuel.

Goderich.—The first vessel to make Goderich harbor this season was the Collingwood, which arrived from the head of the lakes with a cargo of 287,000 bushels of grain for the Goderich Elevator Company. It was followed shortly after by the W. D. Matthews, with 200,000 bushels of wheat for the Western Canada Flour Mills Co. On Saturday morning a little ceremony took place in the town council chambers, where Capt. Peter McKay of the Collingwood was presented with a hat, in accordance with the old custom of so honoring the first arrival of the season.

New York.—A plate-bending roll which has recently been made in America is claimed by the makers to be one of the largest ever turned. It is 35 ft. 6 in. by 3 in. in the body, 40 ft. 8 inches overall, and weighs 60 tons. The ingot from which it was forged weighed 119 tons, and was 67 inches in diameter.

Montreal.—This season not a ton of coal will be brought to Montreal in the Black Diamond ships by the water route from Louisburg to Montreal.

When asked when the first shipment of coal was likely to be unloaded in port from Nova Scotia or Cape Breton, a Dominion Coal Company official said:

"No coal boats are coming to Montreal this year."

The reasons given were firstly the great demand made for the coal on the spot by big industries like the Steel Corporation, whose consumption has increased tremendously.

This factor has become aggravated by under production in the mines. The high cost of bunkering in Britain, which compels British vessels to fill their bunkers at Sydney instead, is also an important factor in the present drastic changes.

Montreal.—The inauguration of a new freight route will take place this week from the port of Montreal, when the steamer Western Star will sail for Antwerp. It is expected that sufficient vessels will be placed on this route so as to provide for three sailings a month. The boats used will be from 8,000 to 10,000 tons gross. P. V. G. Mitchell, formerly of Montreal, is at present general manager of the Red Star Line at Antwerp, and it is this line that will operate the new service.

Sydney.—At a recent meeting of the Sydney, N. S., board of trade, a resolution was passed calling on the Federal Government to subsidize the shipbuilding industry in Eastern Canada. It is believed that the recently formed steel corporation are considering the building of a shipbuilding plant at Sydney, and that the resolution is the result of an intimation of this kind.

Montreal.—The new steamship service between Montreal and West Africa, inaugurated by the Elder Dempster line, was started this week, with the loading of the steamer Fantee. Several other vessels will shortly be placed on this route.

Montreal.—Following the announcement of the activities of the British Empire Steel Corporation it is interesting to note that an unofficial statement has been made that the Dominion Steel Corporation will erect an additional sixty-oven cooking plant at a cost of approximately $3,000,000 and will supplement the 120-oven built last year.

OBITUARY

The death occurred recently at his home in Kingston of Captain Coleman Hinckley, at the age of 79. Captain Hinckley had been engaged in Great Lakes navigation from his childhood, and had served in all capacities on board from boy up to captain. His first trip was made with his father, who owned and sailed the schooner "James Morton." Captain Hinckley subsequently went into steam vessels, and was following his chosen vocation up till the end of 1915. In all of his long career, he was singularly free from accident, never losing a ship or man. He is survived by his wife, one son, one daughter, and several brothers and sisters.

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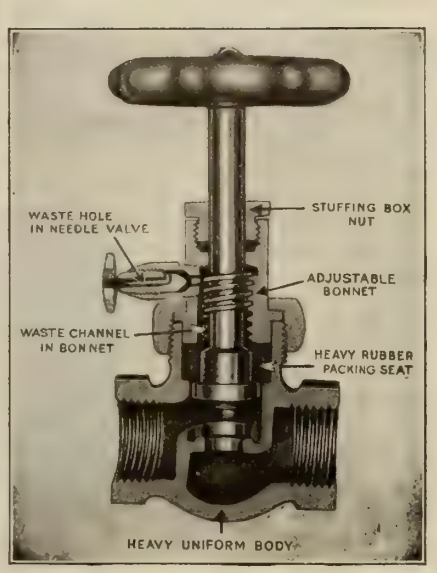

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NAVIGATION NOTICES

QUEBEC

(33) River St. Lawrence—Ile Verte—Change in color of range lights.

Date—Opening of navigation, 1920.

Position of front light—On Government wharf, 312 feet from its outer end.

Latitude N. 48° 1′ 25″, Longitude W. 69° 20′ 42′

Change in color of lights—The fixed white range lights will be changed to fixed red lights.

N. to M. No. 14 (33) 7-4-20.

Authority—Departmental records.

Admiralty charts—Nos. 312 and 2516.

Publication—St. Lawrence Pilot, below Quebec, 1916, page 24.

Canadian List of Lights and Fog Signals, 1920—Nos. 1106 and 1106.1.

Departmental File—No. 21106A.

QUEBEC

(41) Ottawa river—Lake of Two Mountains—New editions of Charts

New editions of charts Nos. 54 and 55 of the Eastern and Western portions of the Lake of Two Mountains corrected to December, 1919, have just been published by the Hydrographic Survey, Department of the Naval Service.

Copies may be obtained from the Hydrographic Survey, Department of the Naval Service, Ottawa, for fifteen cents per copy, payable in advance.

N. to M. No. 17 (41) 20-4-20.

Departmental File—No. 28499.

ONTARIO

(42) Lake Erie—Pelee passage—Southeast shoal lightship—Submarine bell to be rung for experimental purposes.

During the month of July, 1920, the submarine bell on the Southeast shoal lightship will be rung continuously to enable captains of vessels equipped with submarine apparatus to test their apparatus and familiarize themselves with the use of submarine signals.

N. to M. No. 17 (42) 20-4-20.

Authority—Memo. from Commissioner of Lights.

Publication—U. S. Lake Survey Bulletin No. 28, page 451.

Canadian List of Lights and Fog Signals, 1920—No. 1862.

Departmental File—No. 30497.

ONTARIO

(43) Lake of the Woods—Chart issued.

A chart of the Lake of the Woods, with an inset showing the approaches to Kenora, numbered 142 of the Canadian Hydrographic Survey, has just been published by the Hydrographic Survey, Department of the Naval Service.

Copies may be obtained from the Hydrographic Survey, Department of the Naval Service, Ottawa, for fifteen cents per copy, payable in advance.

N. to M. No. 17 (43) 20-4-20.

Departmental File—No. 28499.

ONTARIO — MICHIGAN

(49) Lower Detroit river—Rules and regulations for navigating the Amherstburg and Livingstone channels

Notice to Mariners No. 8 (19) of 1920 is hereby rescinded and superseded by the following:

While the Livingstone channel is being widened the following rules and regulations will go into effect at 12 o'clock noon, Eastern time, May 15, 1920, and will remain in effect until further notice. Rules 1 to 5, published below, cover the regulations, which may be summarized as follows:

Amherstburg channel is to be used by:—

All downbound vessels.

All upbound loaded freight vessels.

All upbound light vessels with more than one vessel in tow.

Optional for upbound passenger vessels.

Optional for vessels under 100 gross tons and for vessels making local stops.

Livingstone channel is to be used by:—

All upbound light vessels when alone or with but one light vessel in tow.

Optional for upbound passenger vessels, but such vessels are subject to the rules governing this channel.

Optional for vessels under 100 gross tons and for vessels making local stops.

Time interval of five minutes required between vessels, and no vessel to pass another between Bar Point light vessel and Ballards Reef.

All vessels using Amherstburg channel will enter or leave Lake Erie via channel to the east of Detroit River lighthouse. All vessels upbound for Livingstone channel will leave Lake Erie via the channel to the west of Detroit River lighthouse.

Caution—Upbound vessels using Livingstone channel will keep well to its westerly side where said channel unites with Amherstburg channel north of Detroit River lighthouse.

Upbound vessels leaving Livingstone channel must proceed above gas buoys Nos. 83D. and 84D. marking the north end of Ballards reef, before crossing the path of downbound vessels.

Downbound vessels have the right of way, but Masters of both downbound and upbound vessels using Amherstburg channel should be unfailingly watchful for upbound vessels from Livingstone channel. All vessels in this locality should navigate under complete control and with the utmost caution.

Rule 1. No vessel of 100 gross tons or over shall navigate the Livingstone channel at a rate of speed greater than twelve statute miles per hour between its junction with the Amherstburg channel at Ballards Reef and the Bar Point light vessel; nor the Amherstburg channel at a rate of speed greater than twelve statute miles per hour between the south end of Bois Blanc Island and the North gas buoys at Ballards Reef, and where the width of either of these channels is restricted by improvements in progress, the speed through such restricted width of channel shall not exceed eight statute miles per hour.

Rule 2. No loaded freight vessel, whether alone or in tow, shall pass through Livingstone channel, in either direction. All downbound vessels, all upbound loaded vessels, and all upbound light vessels with more than one vessel in tow, shall pass through the Amherstburg channel and the channel to the east of Detroit river lighthouse. All upbound light vessels, whether alone or with a single vessel in tow shall pass through the channel to the west of Detroit River lighthouse and through the Livingstone channel, except as stated in Rule 3.

Vessels under 100 gross tons, and vessels making local stops along these routes, are exempt from this rule.

Rule 3. Upbound passenger vessels may use either the Amherstburg channel or the Livingstone channel, but if they use the latter they shall be subject to the rules governing that channel.

Rule 4. All light-draft passenger and freight vessels using the Amherstburg channel in either direction shall pass through the auxiliary channel, (280 feet wide and 14½ feet deep), to the eastward of the improved channel at Ballards Reef.

Rule 5. No vessel shall pass another vessel bound in the same direction in that portion of Livingstone channel between its junction with Amherstburg channel at Bar Point light vessel and at Ballards Reef, nor at any other portion of either Livingstone and Amherstburg channels where the width of the channel is restricted by improvements in progress. Between any two upbound vessels navigating that portion of Livingstone channel from Bar Point light vessel to Ballards Reef, there shall be a time interval of not less than five minutes.

Tugs without tows and vessels under 100 gross tons are exempt from this rule.

ONTARIO

(44) Lake Ontario—Presqu'ile bay—Brighton No. 1 range light blown down—Temporary Light

Position—1,100 feet from Brighton wharf.

Latitude N. 44° 1′ 0″, Longitude W. 77° 43′ 1″.

Temporary light—The Brighton No. 1 range light tower has been blown down and until it is re-erected a temporary fixed white light shown from a lantern on a pole has been placed on the pier.

N. to M. No. 18 (44) 22-4-20.

Authority—Reports from Officer in charge Dominion Lighthouse Depot, Prescott.

Canadian Naval Charts—Nos. 71, 60 and 69.

Publication—U. S. Lake Survey Bulletin, No. 28, page 498.

Canadian List of Lights and Fog Signals, 1920—No. 1781.

Departmental File—No. 21779R.

ONTARIO

(45) Lake St. Clair—Mouth of Thames river—Gas buoy adrift.

Position—At outer end of dredged cut, 1½ miles 320° 30′ from Thames river main light.

Latitude N. 42° 20′ 16″, Longitude W. 82° 28′ 30″

Buoy adrift—The gas buoy is adrift; further notice will be given when it has been replaced.

N. to M. No. 18 (45) 22-4-20.

Authority—Departmental records.

Admiralty charts—Nos. 330 and 332.

Publication—U. S. Lake Survey Bulletin No. 28, page 364.

Canadian List of Lights and Fog Signals, 1920—No. 1902.

Departmental File—No. 30571.

ONTARIO

(46) Lake Superior—Otter island—Fog alarm to be established — Re-establishment of light deferred.

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Position—On northwest end of island.
Latitude N. 48° 6′ 43″, Longitude W. 86° 4′ 0″.
It is proposed to establish a fog alarm at Otter island light-station and the establishment of the light will be deferred until construction work is commenced, which will be about midsummer.
N. to M. No. 18 (46) 22-4-20.
Authority—Departmental records.
Canadian Naval Charts—No. 108.
Publication—U. S. Lake Survey Bulletin No. 28, page 117.
Canadian List of Lights and Fog Signals, 1920—No. 2177.
Departmental File—No. 22177R.

UNITED STATES OF AMERICA

(47) Detroit river—Grosse Isle—Change in character of light
Date—On or about 3rd May, 1920.
Position—East shore of Grosse Isle.
Latitude N. 42° 10′ 4″, Longitude W. 83° 8′ 24″.
Change in character of light—The fixed white light will be replaced by a flashing white light showing one flash of 0.5 second duration every 2 seconds.
N. to M. No. 18 (47) 22-4-20.
Authority—U. S. Department of Commerce, N. to M. No. 16 of 1920.
Admiralty charts—Nos. 330 and 332.
Publication—U. S. Lake Survey Bulletin No. 28, page 370.

UNITED STATES OF AMERICA

(48) St. Clair river—St. Clair Flats canal—East pierhead light to be discontinued—East channel gas buoy, 4, to be established
Date—Opening of navigation, 1920.
Light discontinued—St. Clair Flats canal. East Pierhead light will be discontinued.
Buoy established—East channel gas buoy, 4, will be established in lieu of the above light.
Character of light—Occulting red light every 10 seconds, light 5 seconds, eclipse 5 seconds.
Description—Spar shaped.
Elevation—13 feet.
Depth—22 feet.
Note—The East Channel revetment will be dredged away at this point.
N. to M. No. 18 (48) 22-4-20.
Authority—U. S. Department of Commerce, N. to M. No. 16 of 1920.
Admiralty charts—Nos. 330 and 332.
Publication—U. S. Lake Survey Bulletin No. 28, page 360.

A. JOHNSTON,
Deputy Minister.

Department of Marine and Fisheries,
Ottawa, Canada, 22nd April, 1920.

Pilots, masters or others interested are earnestly requested to send information of dangers, changes in aids to navigation, notice of new shoals or channels, errors in publications, or any other facts affecting the navigation of Canadian waters to the Chief Engineer, Department of Marine and Fisheries, Ottawa, Canada. Such communications can be mailed free of Canadian postage.

NOVA SCOTIA

(32) South coast—Lunenburg harbor—Long shoal—Can buoy to be replaced by gas buoy.
Date—Without further notice.
Position—On southeast point of Long shoal. Latitude N.44° 21′ 15″, Longitude W. 64° 17′ 24″
Change in buoy—The black can buoy will be replaced by a black steel cylindrical gas buoy showing an occulting white light.
N. to M. No. 14 (32) 7-4-20.
Authority—Departmental records.
Admiralty charts—Nos. 342, 343, 730, 1651, 2670 and 2666.
Publication—Nova Scotia Pilot, 1911, page 179.
Canadian List of Lights and Fog Signals, 1920—To be inserted as No. 293.5.
Departmental File—No. 30801.

RESEARCH IN CORROSION

At the recent congress of the British Institution of Metals, a valuable report was read on the corrosion of condenser tubes—a subject in which so many engineers are keenly interested. This report was the fifth of a series, recording researches undertaken by a special committee of the Institute. Experiments have been made with alloys of copper and zinc, and many suggestions made for avoiding or reducing corrosion. In the British Navy trials are being made with exidised tubes, and a British company has been formed to exploit an electrolytic process which deposits and maintains a protective layer of flime on the surface of the tube.

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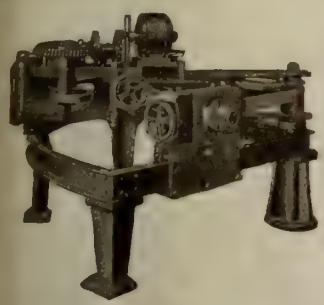

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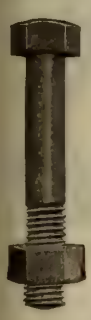

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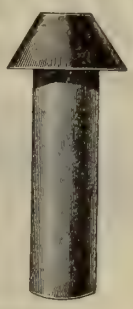

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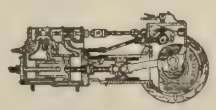

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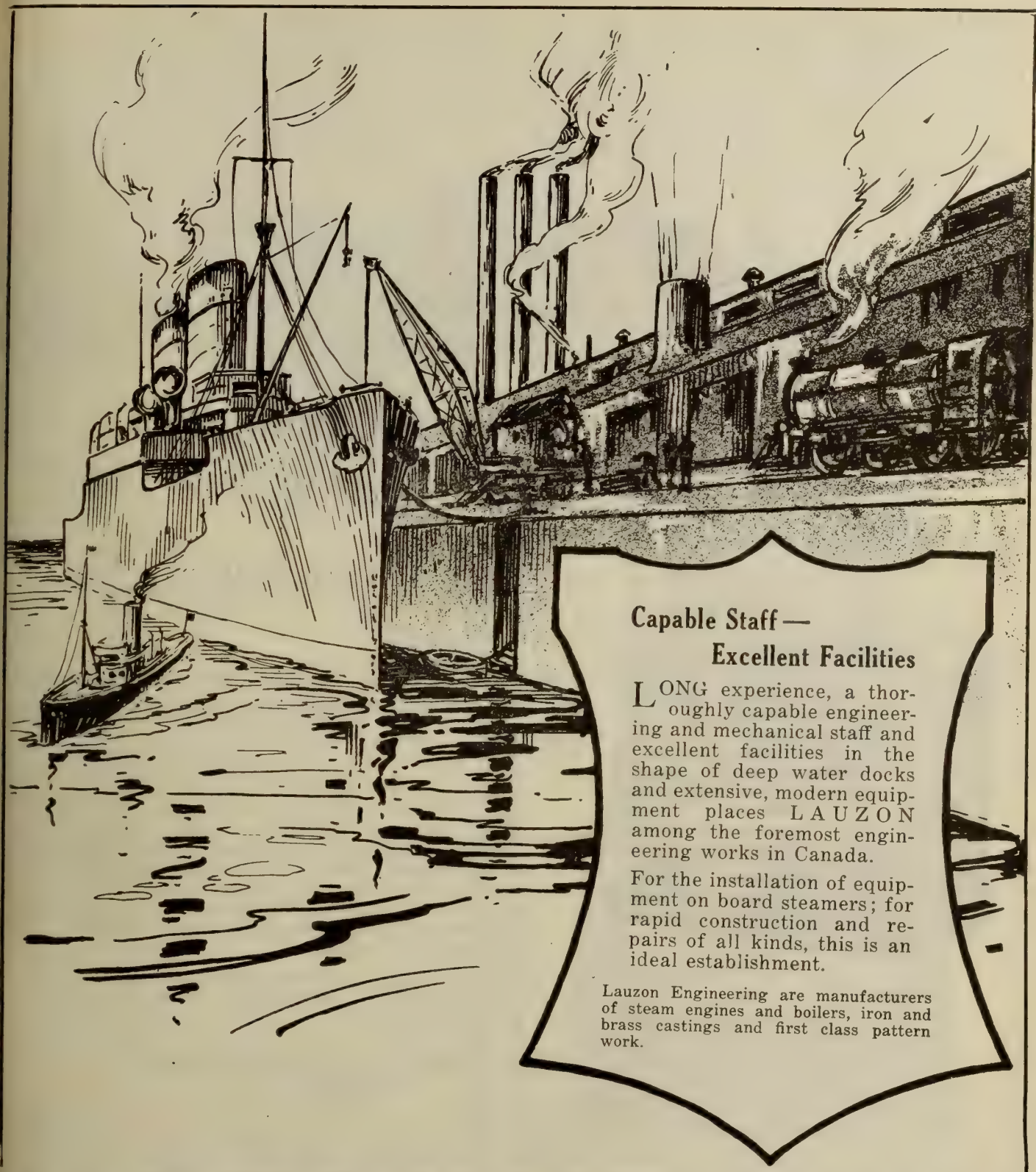

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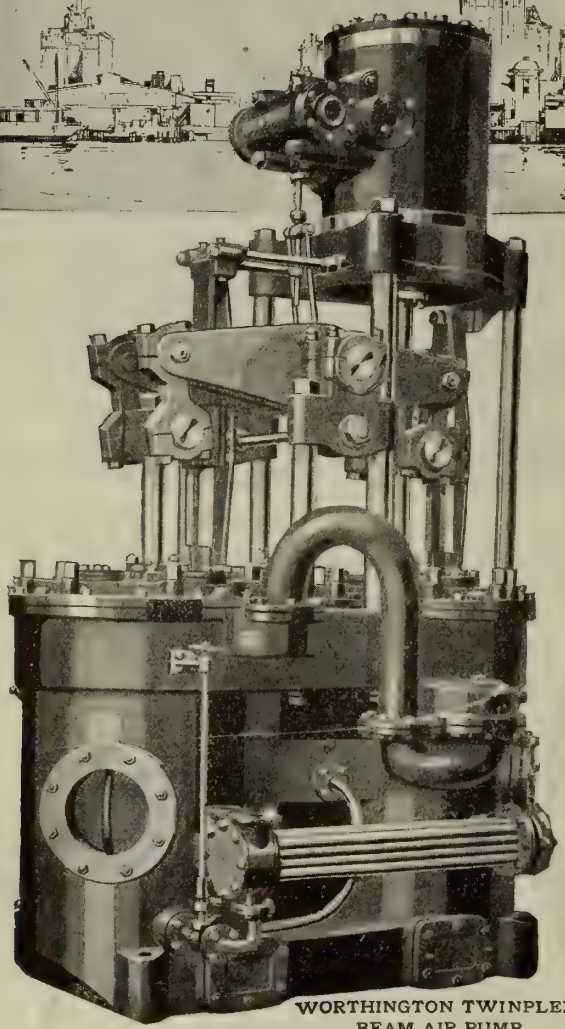

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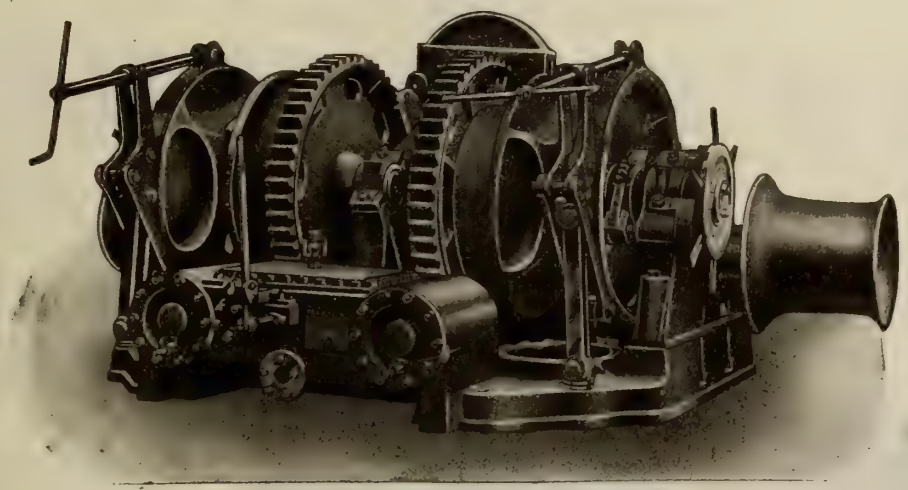

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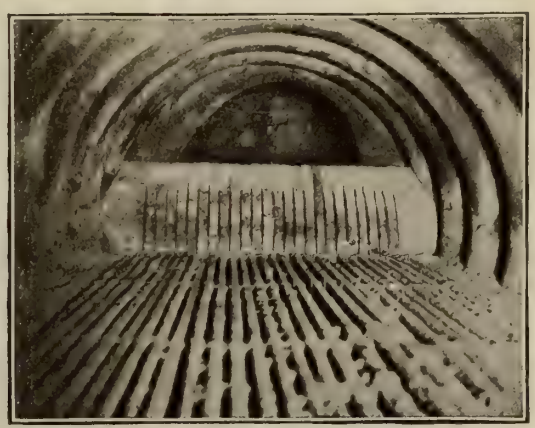

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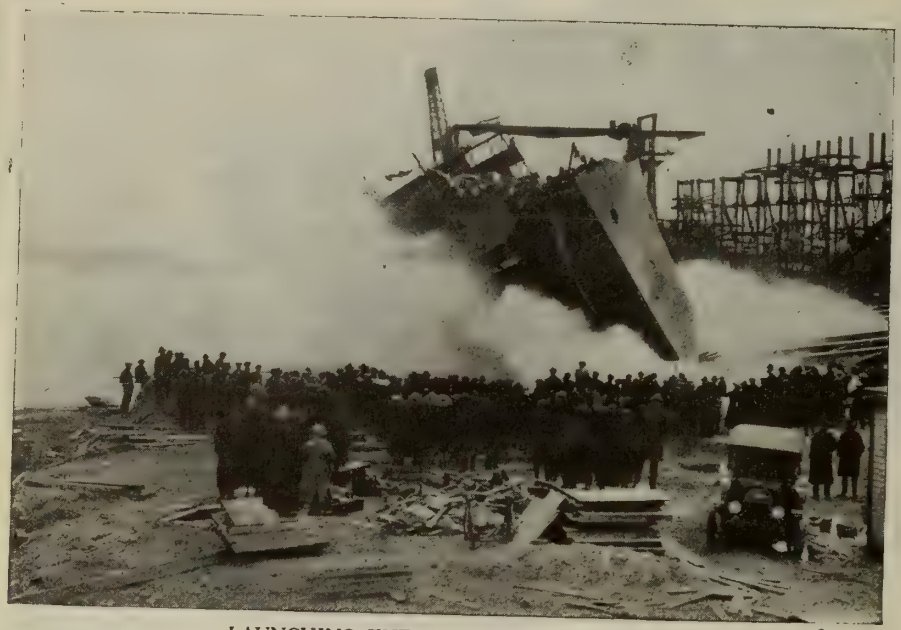

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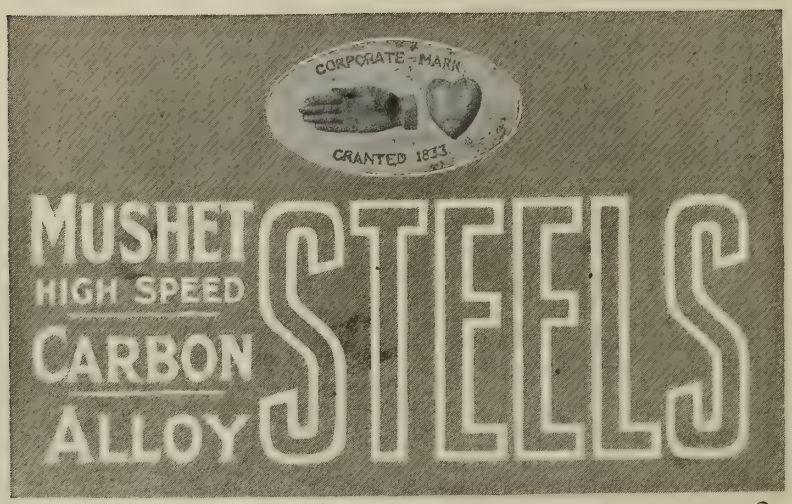

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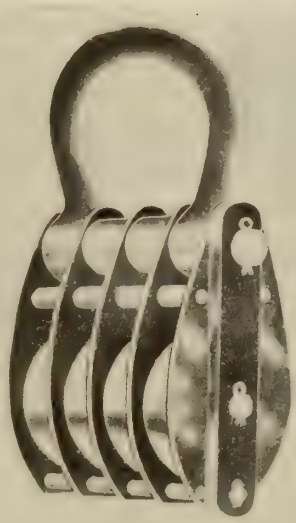

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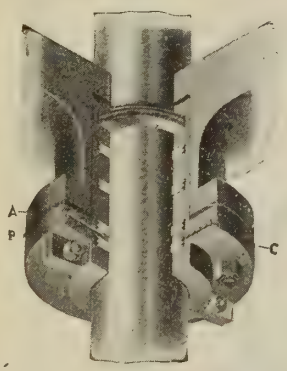

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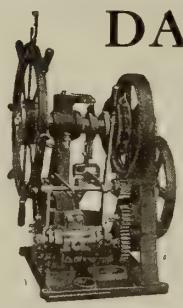

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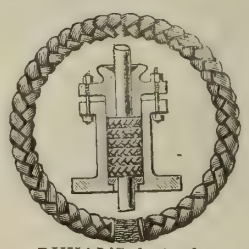

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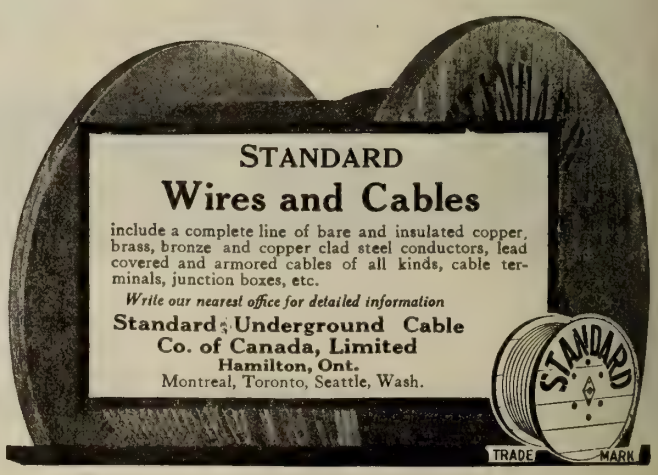
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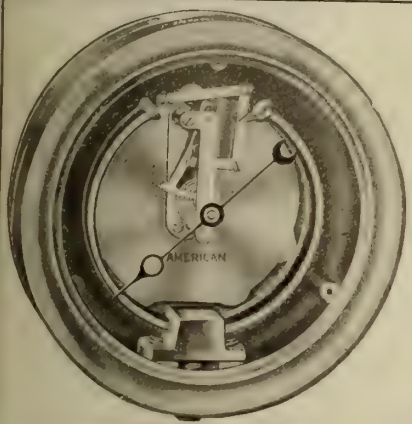

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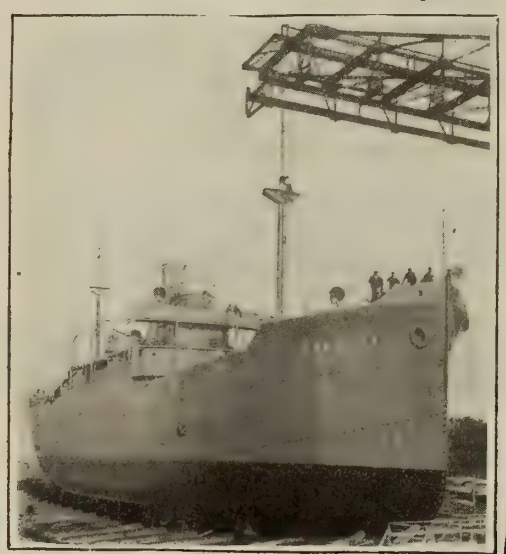

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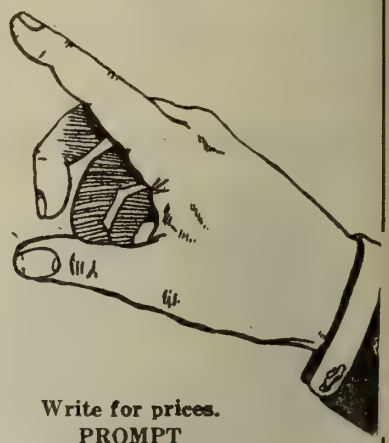

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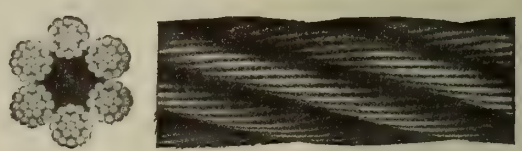

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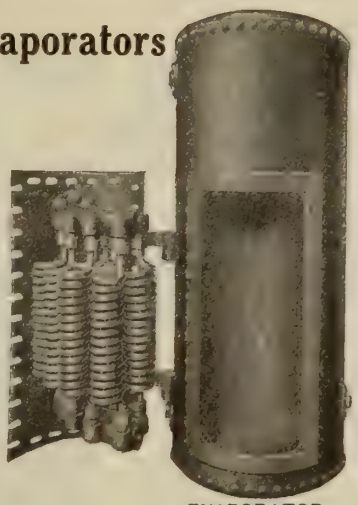

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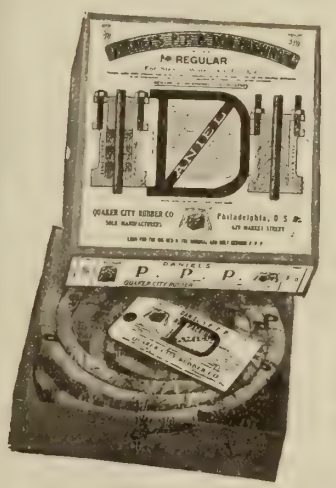

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BARS, GRATE
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Taylor Instrument Companies Rochester, N.Y.

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Tallman Brass & Metal Co., Hamilton, Ont.

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Quaker City Rubber Co., Philadelphia, Pa.

BELTING, RUBBER
Quaker City Rubber Co., Philadelphia, Pa.

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Morrison Brass Mfg. Co., James, Toronto, Ont.

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Parish Supply & Mfg. Co., Chicago, Ill.

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Parish Supply & Mfg. Co., Chicago, Ill.

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John Reid & Co., New York.

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Canadian Fairbanks-Morse Co., Montreal, Que.

BLOWERS, TURBO-
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BOAT RAILINGS
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F. H. Hopkins Co., Montreal, Que.
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Wager Furnace Bridge Wall Co., Inc., New York, N.Y.
Wooley & Co., E. L., Providence, R.I.

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BOILER MOUNTINGS
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Can. Vickers, Ltd., Montreal, Que.
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Doxford & Sons, William, Sunderland, England.
Engr. & Mach. Wks. of Can., St. Catharines, Ont.
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MacKinnon Steel Co., Sherbrooke, Que.

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Hopkins & Co., F. H., Montreal, Que.
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CASTINGS, ALLOY
Tallman Brass & Metal Co., Hamilton, Ont.

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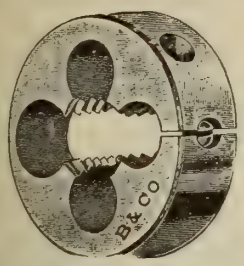

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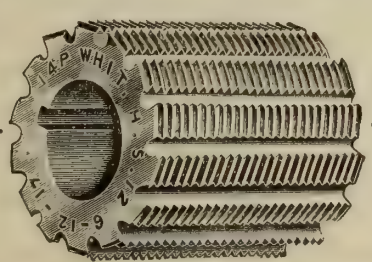

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Taylor Instrument Companies, Rochester, N.Y.

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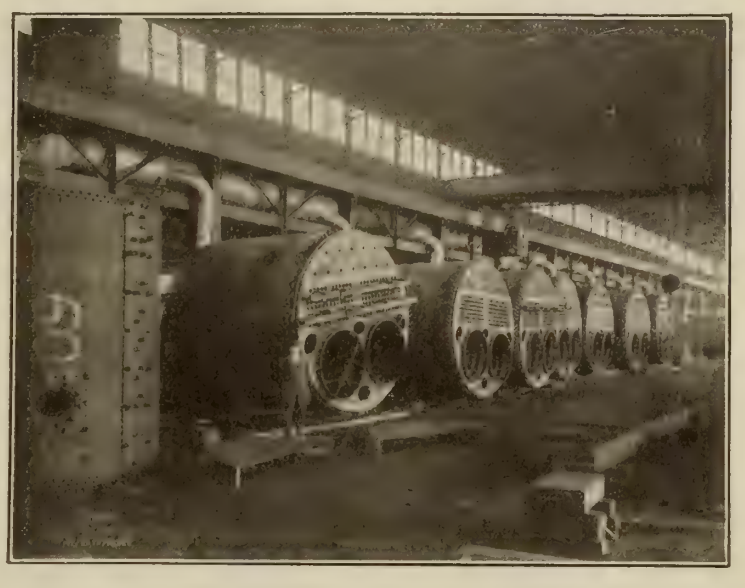

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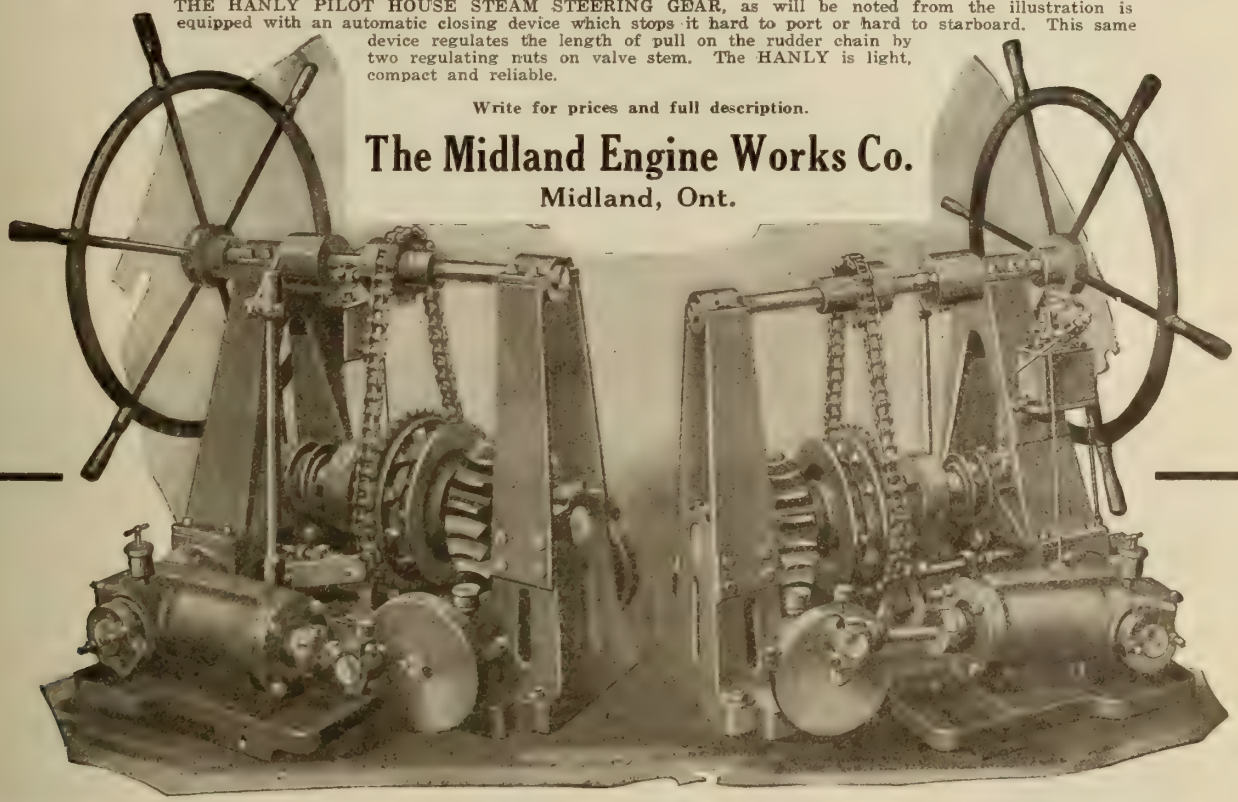

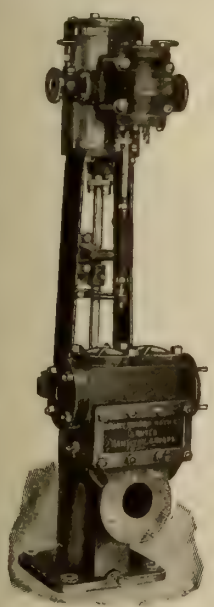

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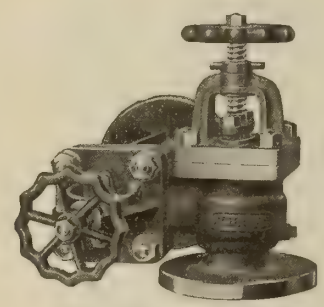

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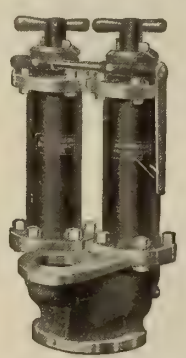

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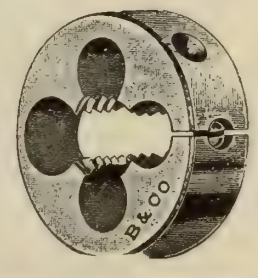

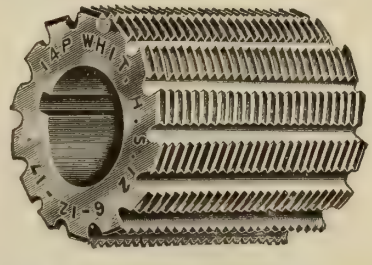

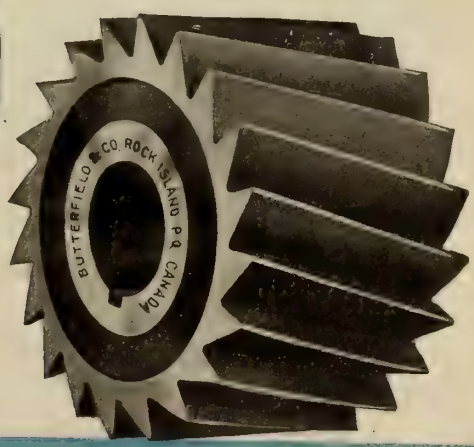

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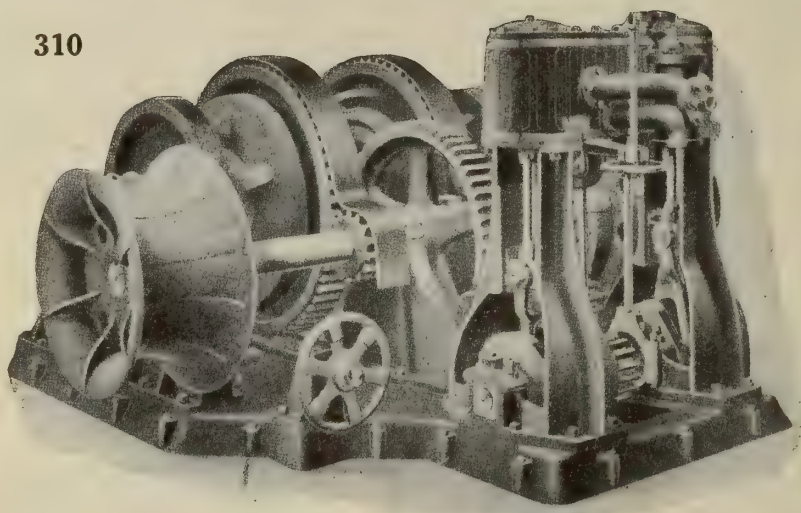

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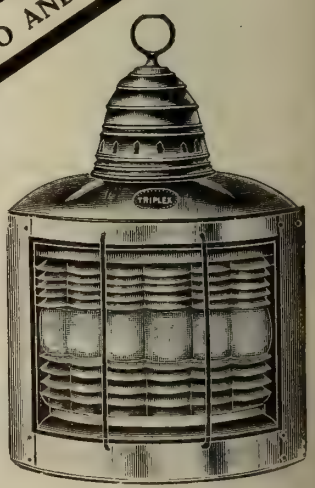

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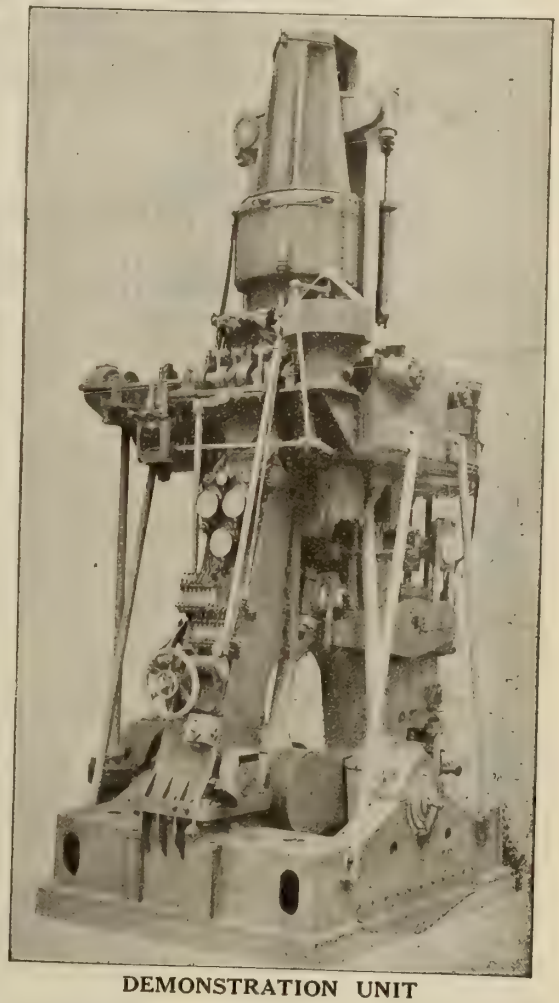

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3/8"	3	1 1/2"	6
7-16"	3	Circumference	Coils
1/2"	19	1 1/2"	2
9-16"	4	2"	6
5/8"	19	3"	8
3/4"	26	3 1/4"	4
13-16"	3	4"	2
7/8"	19	5"	1

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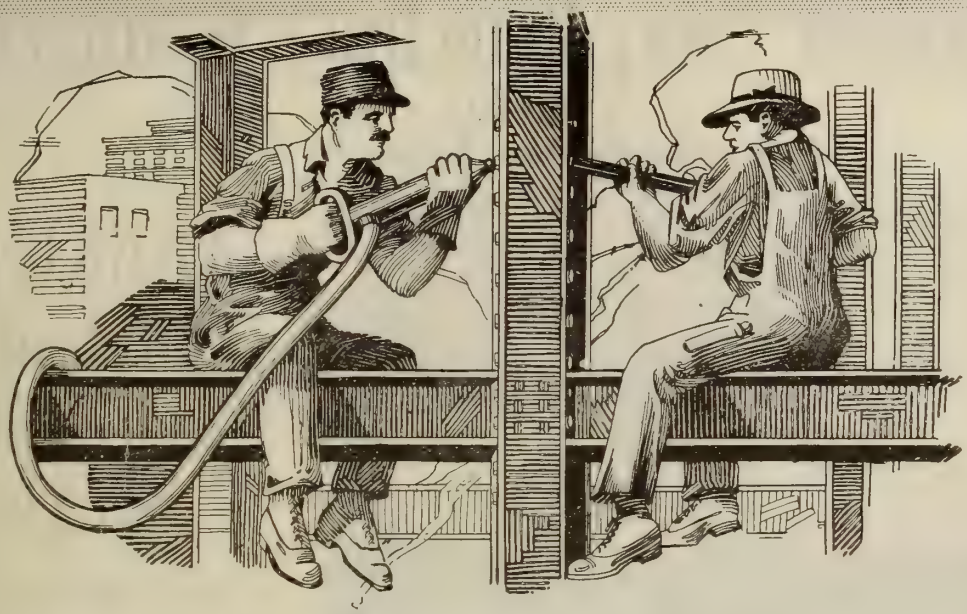

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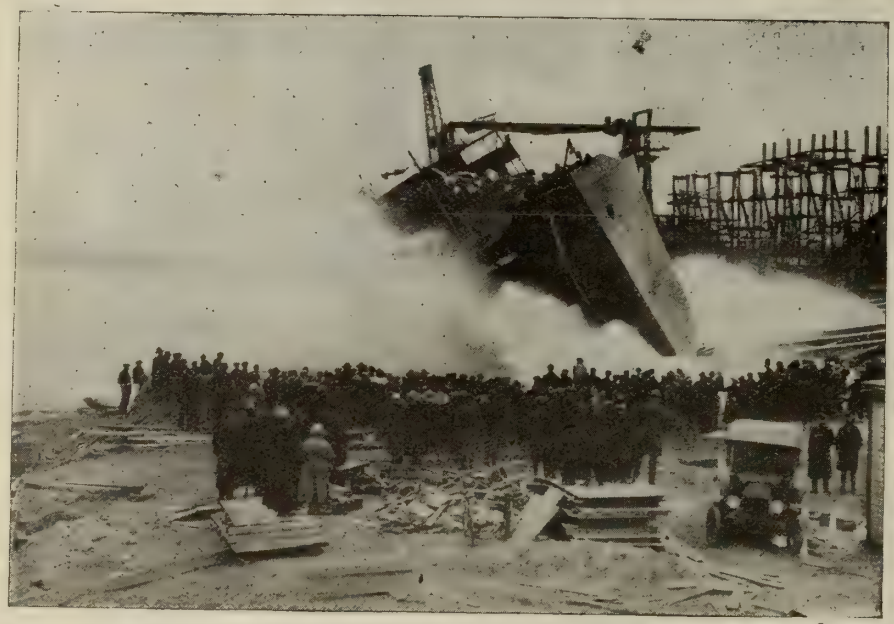

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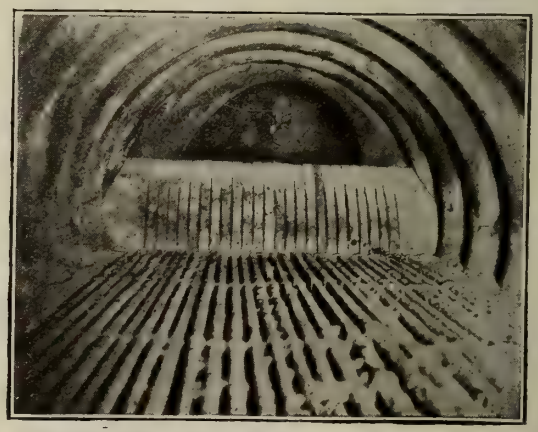

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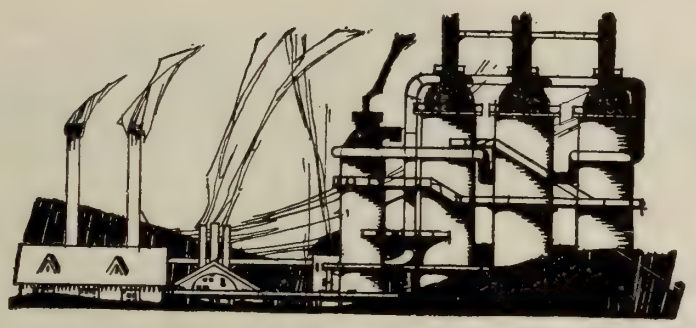

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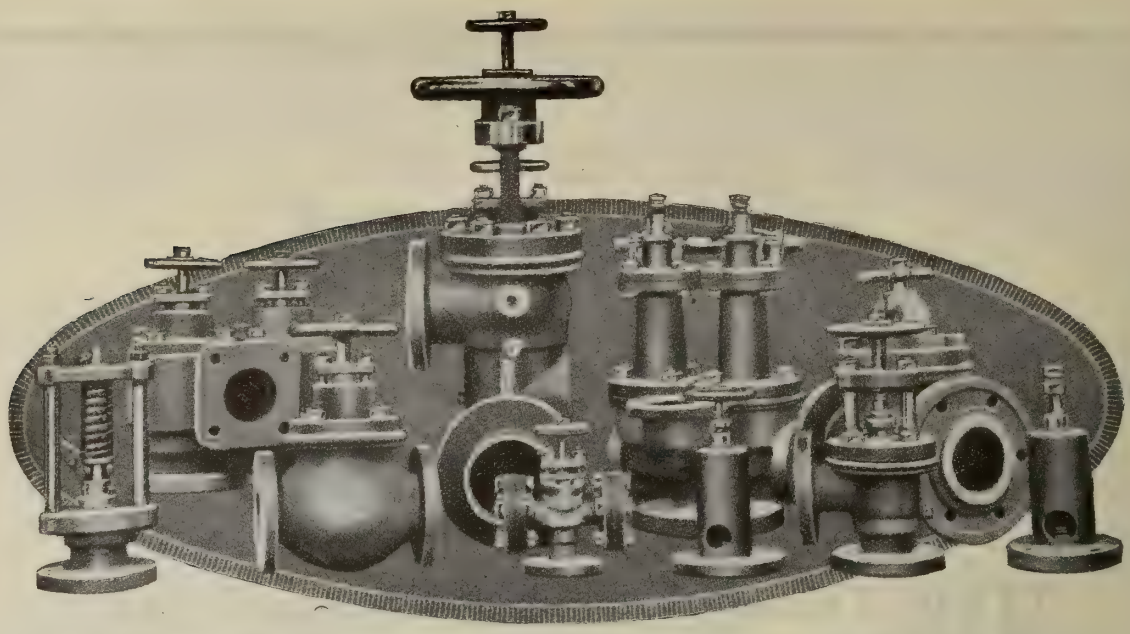

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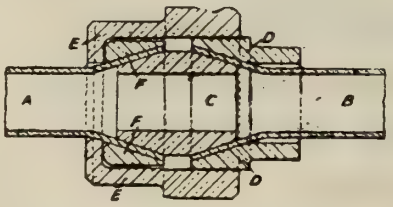

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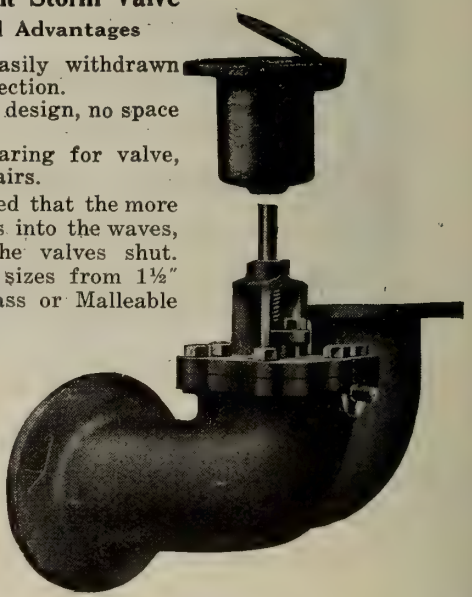

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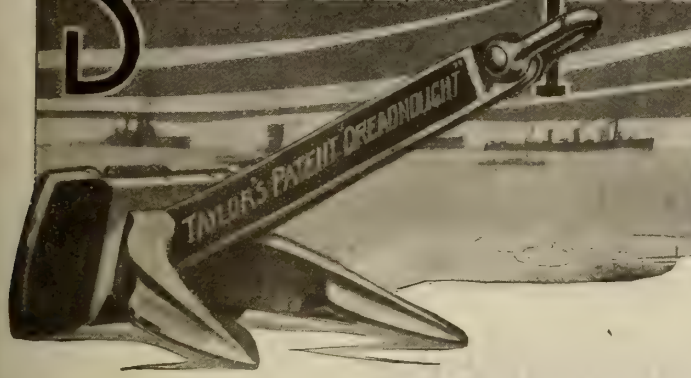

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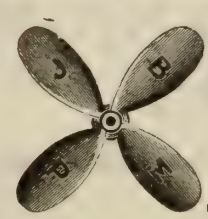

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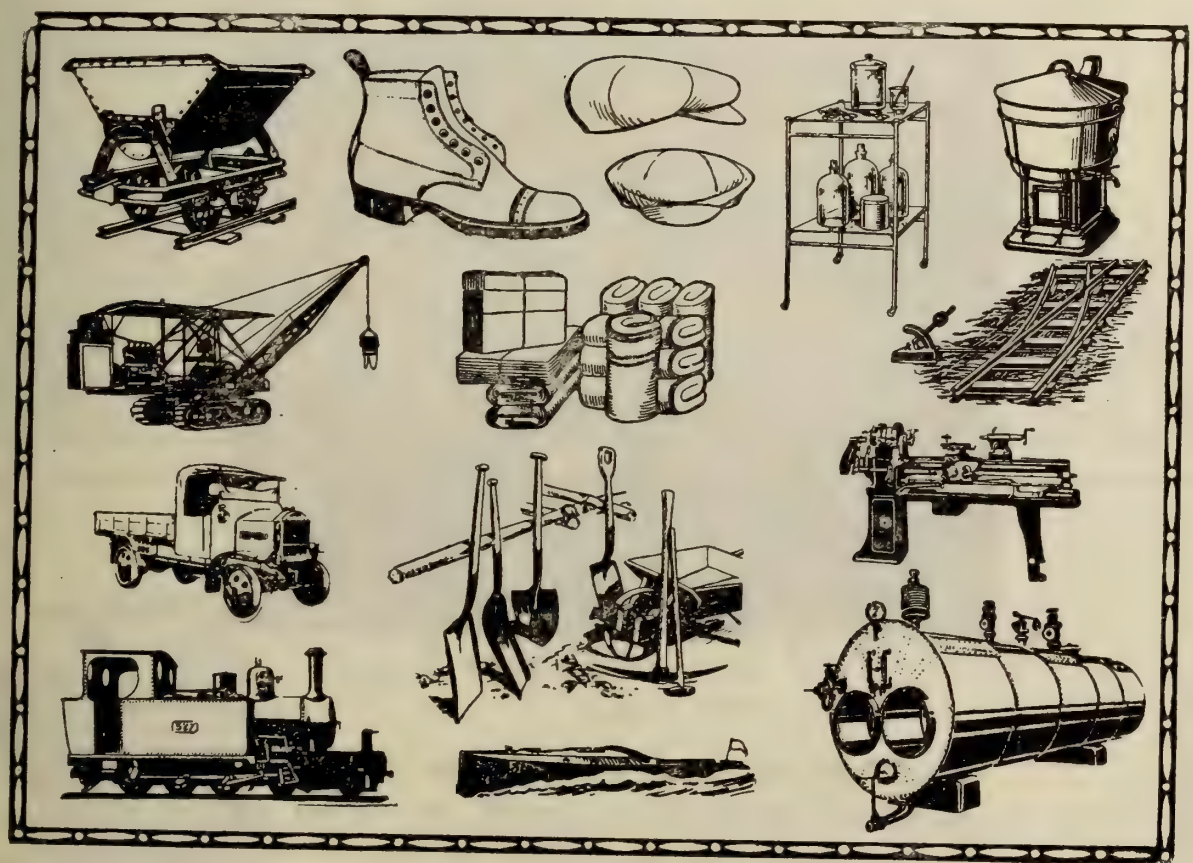

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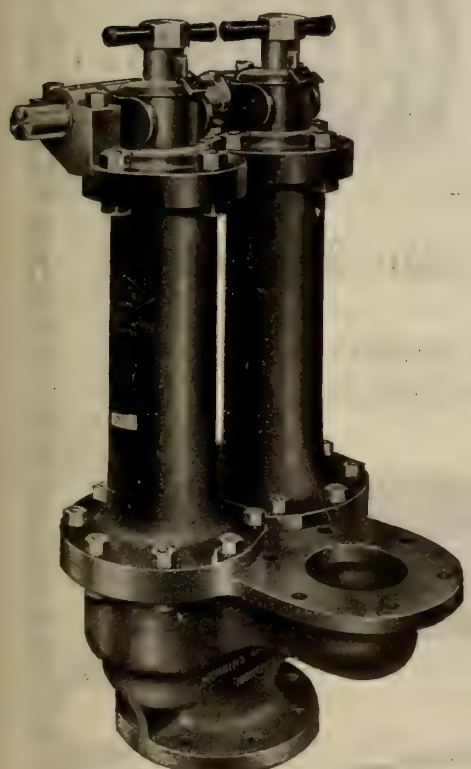

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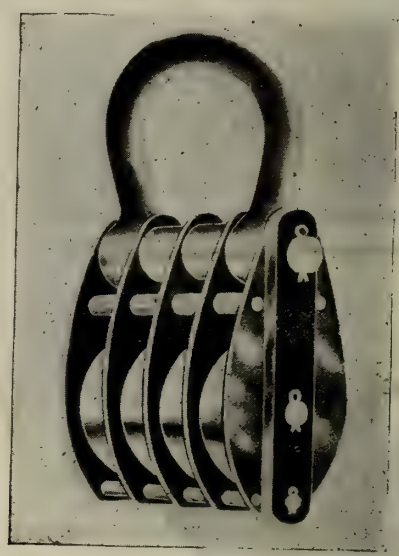

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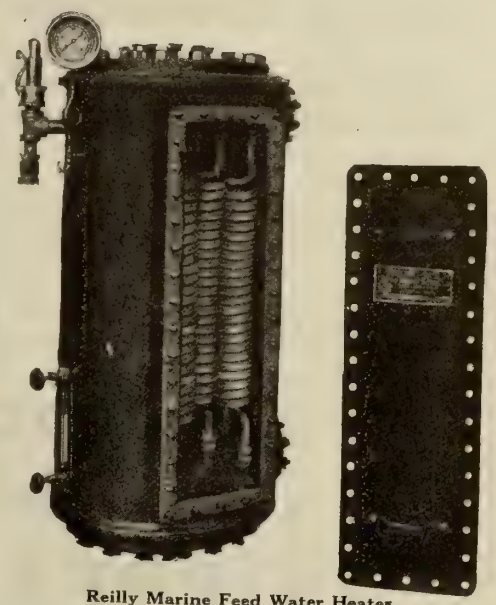
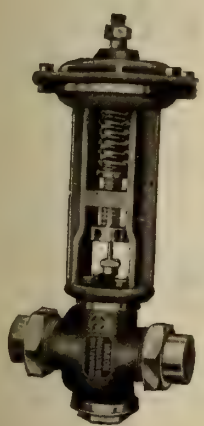


Reilly Marine Feed Water Heater



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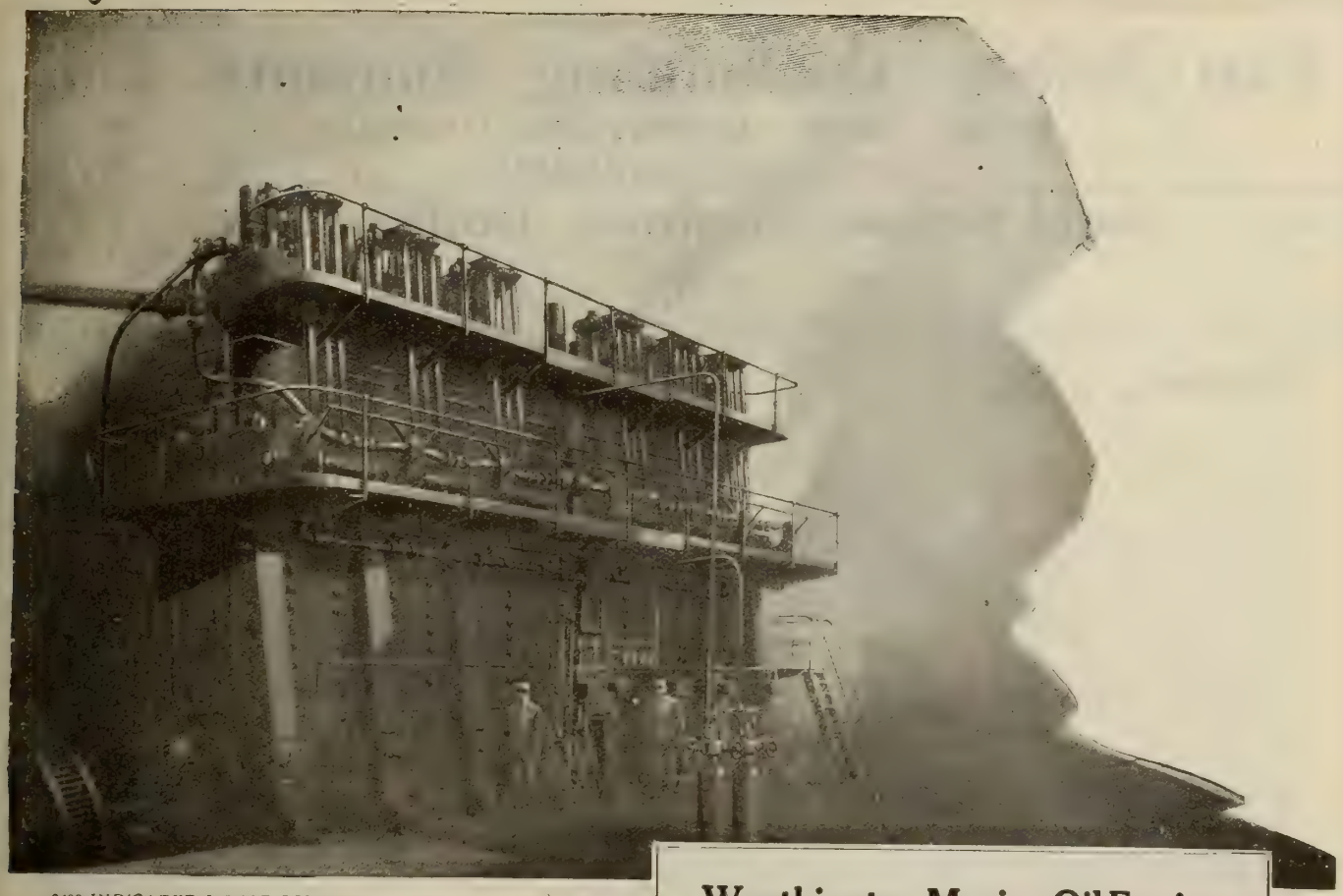

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Worthington Marine Oil Engine

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It elevates Worthington up to the same high plane in the motorship field that they occupy in the steam driven. For progressive ship operators who would take advantage of the lower operating and maintenance costs made possible by the use of crude oil engines for ship propulsion, this Worthington development should have a special interest.

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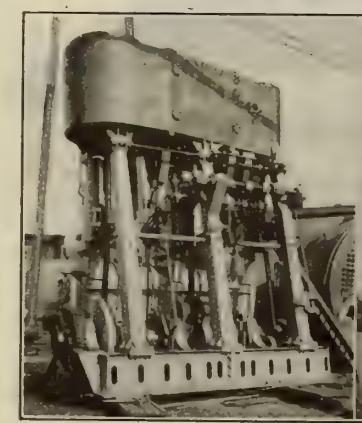
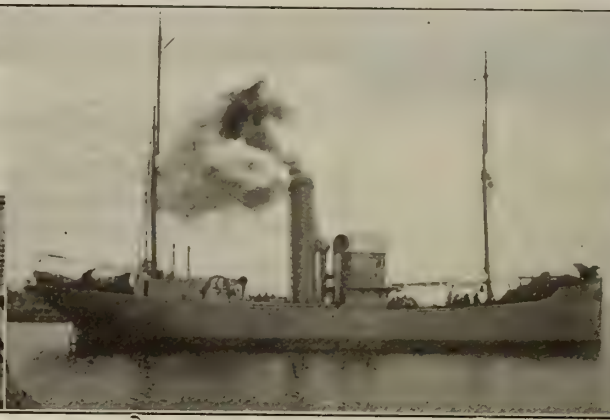
Breadth Moulded 52 ft.

Depth Moulded 28 ft. 9 in.

Gross Tons 6,905



1500 H.P. Engine, Triple Expansion



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Wheel Casting 14 ft. 9 in. diameter

The above are some of the products of our plant
We are also fully equipped with every modern facility for REPAIR WORK

DRY DOCK 700′ x 93′ x 16′
Four Building Berths

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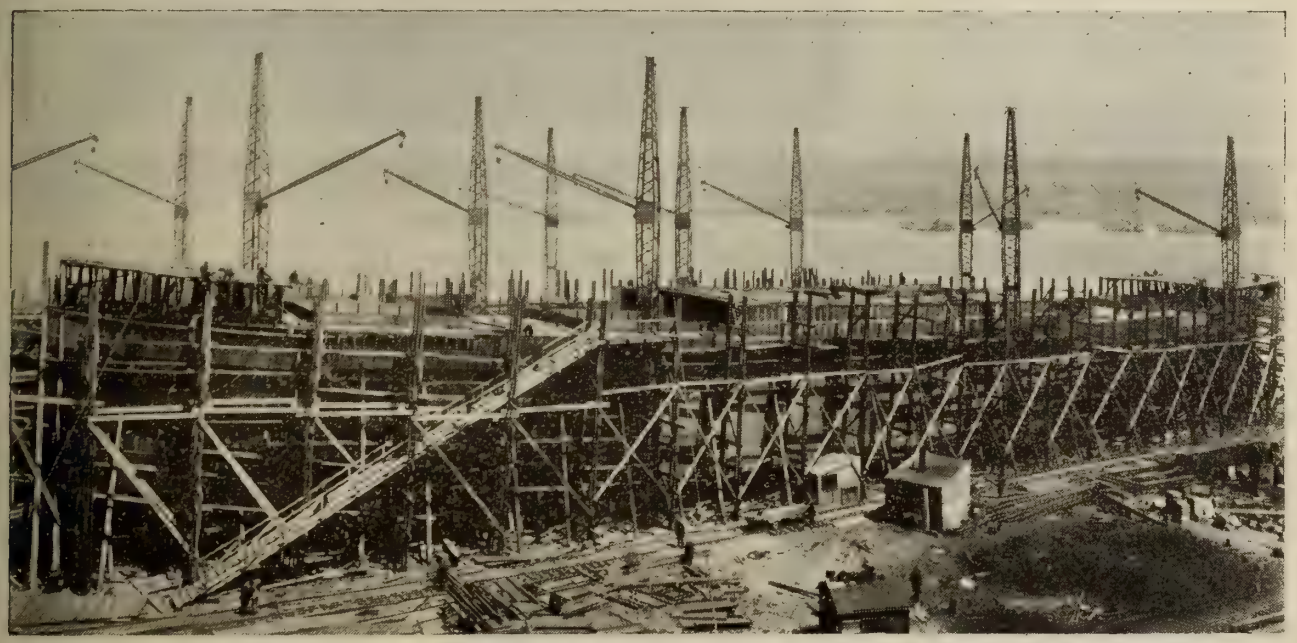
PORT ARTHUR, ONTARIO

MARINE ENGINEERING
and
Canadian Merchant Service Guild Review

Vol. X. JUNE, 1920 No. 6

Halifax Shipyards Has Reached Launching Stage

Will Have Two Vessels in the Water Very Shortly, and Are Proceeding With Two More of 10,500 Tons Each—Ample Dry Dock and Machine Shop Facilities in Seacoast Yard.



ANOTHER VIEW OF "CANADIAN MARINE."

THE plant of the Halifax Shipyards, Limited, has reached a milestone in its development, with the launching shortly of the S.S. "Canadian Mariner" at the shipbuilding yards of the company at Halifax. This steamer is the first to be completed, and will have a carrying capacity of 8,350 tons, is to be 413 feet in length overall, and will draw 25 feet when loaded, having a speed of 11 knots. Laid down last August, work on the "Canadian Mariner" progressed throughout the winter, and shortly now its launching will mark an historic occasion.

Three other ships are in hand at the Halifax yards, like the former, all for Government contract. The "Canadian Explorer," being in course of active construction, in size similar to the "Mariner" and will be launched in the near future.

Two other keels have been laid, and will be the next constructed, and will be 10,500 dead weight tons, 430 feet long, 56 feet beam, 38 feet depth, and of 12 knots. These will be the only three deck type steamers yet contracted for by the Government, and will be 1,900 tons larger and a knot speedier than any others yet understaken.

While the "Mariner" will be the largest steel ship yet built in the Maritime Province, and the first steel steamer to be built and launched in Halifax, it is but the forerunner of much larger craft that will be probably built at Halifax. The yards there cover forty-five acres, and have a water frontage of 3,300 feet, and while the berths as now constructed take ships 500 feet long, they can be extended to take 700 feet steamers, and will be able to accommodate the proposed 15,000 ton, 18 knot, combined passenger and cargo boats that it has been hinted at Ottawa, may be undertaken by the Government for the Canadian Merchant Marine. The Halifax yards would be amply equipped to construct any naval craft for the Dominion as may be ordered if Admiral Jellicoe's recent recommendations are carried out in the future.

Situated as it is on the shores of Halifax harbor, which the "London Times" states is "the world's third most important port," and in close proximity to its source of supply for steel ships' plate from the new rolling mill at Sydney, the Halifax plant has a strategic position that cannot be gainsaid, not only for actual construction, but also for dry-docking and repairs.

The Docking Facilities

The graving dock, built of granite, is 585 feet long, 100 feet wide, and can take ships 560 feet long and up to 15,000 tons, and has accommodated British, American and foreign war ships, and passenger steamers of such tonnage.

A steel floating dock of 50,000 tons capacity is in contemplation, and a sea wall is to be constructed to provide safety for material being delivered to craft under repair there. The water front will be deepened, and anchors provided to hold this massive dock.

In addition to the graving dock in the main plant, the Halifax Shipyards, Limited, have supplementary facilities for repair in the marine railway at Dartmouth on the eastern side of Halifax harbor, which is a self-contained property, with four ship's cradles, which

may accommodate two vessels each, and can take craft up to 3,000 tons.

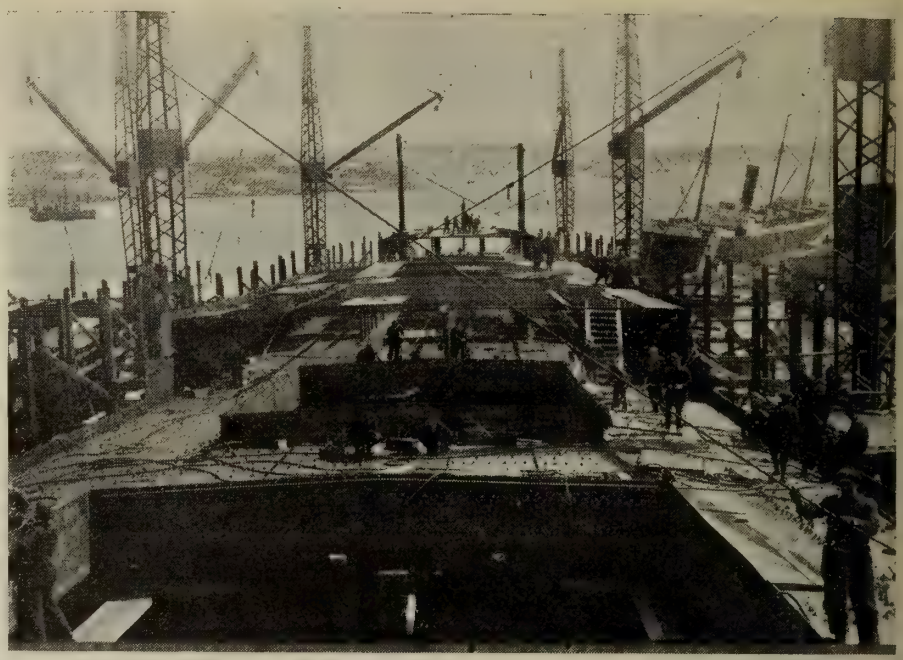
The Maritime Salvage Company is an auxiliary of the Shipyards Company, and is equipped with the "Lord Kitchener," a floating crane of 75 tons capacity, the tugs "Maggie Marshall," "Sarnia City," etc., every facility for salvage, towage and aid.

During the past year the shipyards have rebuilt three steamers, the S. S. "Mariska," the S.S. "Iver Heath," and the S.S. "Troja," and at present the S.S. "Kamarima" of the Canada Steamship Lines, Limited, is being converted from a cargo boat into a combined cargo and passenger craft.

New Buildings and Equipment

Many new buildings have been erected during the past year; all being of modern fire-proof permanent construction, of steel frame and reinforced concrete, and provided with a three-way sprinkler installation, kept under constant 40,000 gallon pressure from a 75-foot steel tank; which is supplemented by an emergency Fire Underwriters' pump of 1,000 gallon capacity a minute, also fire apparatus located throughout the yards.

The Administrative Building is located at the main gate, being 280 feet long, 50 feet wide and three stories high, with a small portion four stories high, housing the hull drafting room. The employment, time-keepers, and paymaster's offices, together with the first aid room, and medical officer's quarters are located in the southern section of the ground floor. In the north end is the hydraulic and air compressor room from which air is supplied in pipes through a reinforced four-foot square concrete trench for the pneumatic machinery and tools. The main heating plant is also situated at the north end of this building. The purchasing, traffic and inquiry offices, together with the private branch telegraph lines and telephone exchange are at the main entrance. The second floor houses the stores department; the superintendents of hull construction and marine engineering, also Lloyds' representatives. The third floor is devoted to the offices of General Manager McLurg, and Operating Manager Paige; the board room, chief accountants' department, cashiers, publicity, insurance and stenographic offices.



"CANADIAN MARINE" UNDER CONSTRUCTION.

The plate shop, 600 feet long and 75 feet wide, is in the north end of the yards; 500 feet of the building being two stories high, the upper floor being the mould loft, 50 x 75 feet, all clear working space.

The marking building, 340 feet long, is attached on the west side, with a width of 30 feet.

GRAVING DOCK, WITH OFFICE BUILDING ON RIGHT, AND PART OF MACHINE SHOP ON LET.

The plate shop is equipped with punch, shear, manhole, and angle cutting machines, also hydraulic benders, hammers, straightening rolls, scarfing machines, etc. At the north end of the building is the blacksmith shop with air hammers, forges and oil furnaces. The angle and plate furnaces are situated here, oil being used. Overall is a 5-ton electric crane to move material in course of fabrication, passing it on completion to travelling locomotive yard cranes for conveyance to the ways for erection on the ships. A five-ton electric overhead crane serves the marking shop. A fan house stands north of the blacksmith shop, which latter contains an angle rack for storing smithy iron.

The machine shop, 300 feet long, 100 feet wide, stands 50 feet east of, and parallel to the graving dock, and contains the usual lathes, machinery, etc. A 15-ton overhead crane serves the building, in the southern portion of which is temporarily housed the heavy timber construction shop in which the ships' ways are built, pending occupancy of the proposed saw mill and joiner shop, 200 feet x 50 feet, and two stories high, to be located north of the plate shop. A jointed shop adjoins on the south, and the pipe fitters and electricians' building, 90 x 40 feet, stands at the north. The heating plant for both these buildings is being constructed at the south end of the machine shop. Electric fans force the hot air through 48 in. metallic ducts to heat this and the pipe shop.

The power plant, located in the extreme south of the yard, has a boiler room, 143 feet x 50 feet, which will later be of the oil burning type, and a generator room, 93 feet x 50 feet, with three turbo generators developing 3,000 k.w. A 15-ton overhead crane serves this room. The reinforced concrete chimney from this building stands over

VIEW OF THE MOLD LOFT.

two hundred feet, and is a notable landmark.

The foreman's building has just been completed, the top floor containing their offices; the basement serving as a store's room.

An oil stores' building is under construction, and additional stores buildings and coppersmiths' shops are to be built.

The clock house, 92 feet x 15 feet at the main gate, and adjacent the watchman's offices, contains twenty clocks, automatically regulated to Standard Time by a master clock in the telegraph office; correction being received daily from the Government Metorological Service, over the private telegraph line, which, with 50 private telephones serves the plant.

The Sydney Mills' New Plate

Recently the Halifax Shipyards received the first shipment of newly- rolled Canadian ships' steel plate from the Dominion Steel Corporation's new $5,000,000 plate mill—a special train-load of twenty-six cars having arrived at the yards, being unloaded at the storage dump for angles and plates on the east side of the plate shop. The material here is handled by an electric over-head craneway, 400 feet long and 85 feet wide, of 7½ tons' capacity, which spans the plate racks and assembling skids, swinging plate and angles into whatever part of the plate shop they are needed.

It is of interest to know that the plate from Sydney is considered by Operating Manager Paige, of the Halifax yards as equal in tensile strength and appearance to Pittsburg plate, of correct shear, and fully up to Lloyd's requirements.

Almost $2,000,000 Wages Yearly

There is at present over seventeen hundred employees on the pay roll, which averages about $150,000 a month. Over twelve hundred of the men are Canadians, some two hundred are Old Countrymen who have had experience in the shipbuilding plants of the Clyde, and elsewhere in the British Isles; some hundred of the men are Newfoundlanders, and there is a sprinkling of Scandinavians and Americans, with a few Europeans, all working together to turn out craft equal to those built in England, Ireland or Scotland, in design, workmanship and efficiency. Eventually the company propose constructing their own marine boilers, engines, pumps, etc., and all fittings and furniture appertaining to the complete construction of ships.

One notable fact is that there are over four hundred returned soldiers in the company's service; the Halifax yards are probably employing a greater percentage of ex-service men than any other Canadian industry. All things considered, the returned man get the preference in the company's employment department.

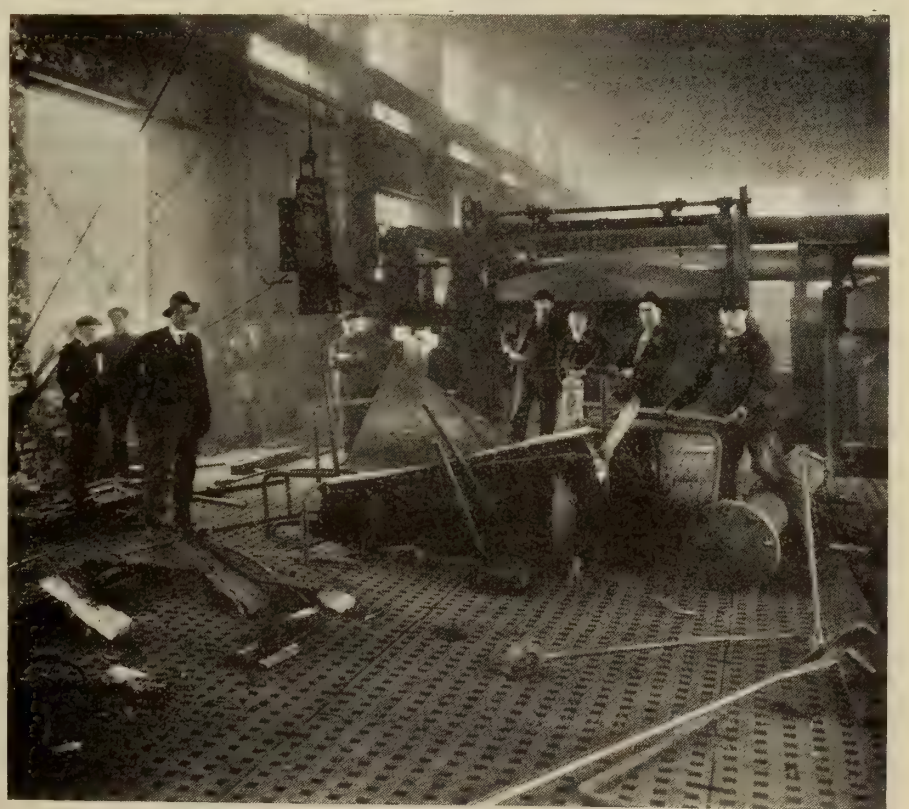
Over a thousand of the employees are married men, and the housing problem is one of deep concern; the management obtained a number of houses nearby for sale or rental at reasonable price to those needing them, thus providing comfortable homes for familied men within easy reach of the yards.

The King Edward Hotel, owned by the company, on a nearby corner, provides living quarters for a considerable number of the unmarried men, with opportunities for assemblies and social evenings in its spacious banquet hall.

Extensive welfare and social service work is carried on. An athletic and social club, with an auditorium seating 600 and fitted with noon-hour lunch facilities, recreation features, etc., is provided. Weekly dances and social entertainments are carried on, the athletic teams entering in the city basket ball, baseball, and other sporting leagues.

A monthly house organ, the "Shipyard Times," is published and distributed free to all employees.

"Safety first" principles are carried out through the plant, and a first aid room, conducted by trained nurses is



BENDING TABLE AND GAS FURNACES.

INSPECTING PLATE FROM NEW ROLLING MILL AT SYDNEY.

Mr. W. G. Wilson, Supt. Sydney Rolling Mill; President Whitman, Halifax Board of Trade; B. E. Mitchell, Manager Royal Bank, Halifax; Captain McLurg, General Manager Halifax Shipyards; Allen Montgomery, Manager Furness, Withy & Co., Halifax.

maintained under supervision of one of the city's senior medical men, who is available twice daily. Numerous first aid cabinets are located in the yards and St. John's Ambulance classes meet for weekly evening instructions.

Prominent Officials

The Halifax Shipyards is officered by some of the foremost men in the shipbuilding and iron and steel industries of Canada. The president is J. W. Norcross, managing director of the Canada Steamship Lines, who is also a director of the Canadian Vickers plant, and also of the Sterling Bank of Canada.

Roy M. Wolvin, vice-president and managing director, is the newly- elected president of the Dominion Steel Corporation; president of the Montreal Transportation Company, and many other allied interests.

The general manager is J. E. McLurg, who, before going overseas as an officer, was for thirteen years with the Lake Superior Corporation at the Soo. In July, 1918, on his return from active service, he assumed the management at Halifax.

Mr. J. F. Paige, operating manager, joined the Halifax Company last December, having previously been general manager of the Port Arthur hipbuilding Company, and, with other extensive experience in American plants.

Much headway has been made at the Halifax yards since June, 1918, when the present company acquired the site, and it is but an earnest of the considerable progress that is to follow, not the least impetus for which is the fact of the close connections of its executive heads with the new British interests in the Nova Scotian iron and steel industries, and the all important and far-reaching ramifications of the proposed mergers and reorganization of these allied enterprises into one vast organization and under co-ordinated control.

From Winnipeg to Hudson's Bay

THE captain, mate, and engineer, the last-named being the writer, left Winnipeg in May for York Factory, Hudson's Bay, to take over the M.S. "Fort York," which had wintered at Port Nelson, the Hudson Bay Railway terminus. The distance from Winnipeg to Nelson is roughly 860 miles, but the party were able to cover only 630 by train, which was as far as it ran at that time, bringing us within 230 miles of the Bay. Our first day's journey from Winnipeg brought us to The Pas, the gateway of the North. At the last-named place we had to wait a few days for the construction train, hence the writer had many hours to look round.

At The Pas great activity was evident, owing to reports of gold and mineral claims being staked in that vicinity. Naturally, a rush ensued, and boats with oil engines were the first to be chartered for use on the Saskatchewan River. In due course the construction train was ready, so the party with their outfit proceeded. This train is commonly known as the "Muskeg," for it invariably runs off the track and buries itself in the swampy vegetation bearing that name, but happily nothing happened on this trip to leave a lasting impression. The total distance travelled by this train, some 50 hours' ride, was 200 miles. On arriving at Picquotenay, the end of the train journey, the party was notified that if it would wait a day or so a gasoline-engine-propelled car would be placed at their disposal, which would take them to the End of Steel; therefore, bad riding being better than good walking, we decided to wait.

140 Miles by Railway Motor Trolleys

During our stay we had some good fishing. One, by using a troll, could catch a dozen fish in ten minutes, and often the party would have a regular Old Country fishing contest. Our surplus catch we would trade off to a Chinese eating-house keeper for 2 per cent. beer, for none of us were Pussyfooters. In due course the gas car arrived, but owing to the amount of gear it was found that two would be needed, the writer and the mate driving one each These cars proved to be wonderful contraptions, both being single-cylinder machines of 5 h.p., air-cooled. To cover the distance of 140 miles, to the End of Steel, took 1½ days, this owing to sunkinks in the railway line, and only careful driving saved our necks. At times we were knocking off 25 miles per hour, but mostly about four. Anyhow, we got there, and many thanks to the gas cars, which not only saved much time, but a lot of blue atmosphere if we had to walk.

The Kettle Rapids, which is at the end of steel, was out next stop. At this place we found the ice had not departed, thus making it impossible to use the canoes, much to the writer's disappointment, for good fun is to be had shooting the many miles of rapids, of which the Nelson River is full. After a day or so at Kettle Rapids, the mate and writer decided to walk to Port Nelson, 90 odd miles, but, he says, never again, under such conditions. What with mosquitoes, the heat of bush fires, and the Muskeg, it was very trying. Yet the worst to come was the narrow, winding trail, which, if one stepped out of, he sank up to his knees. After some 3½ days' tortuous "hiking," the mate and myself came to the Air-hole River in the afternoon, at which place we ran across a canoe. Again, bad riding being better than worse walking, came into play, for here the ice had gone, so into the canoe we got. This river ran into the Nelson River, so at early daybreak we landed up at Port Nelson, stiff and weary, but not downhearted.

After a day or two's rest the writer overhauled the machinery of the motor schooner "Fort York," a boat of some 85 tons deadweight and 64 tons register, length 86 ft. 9 ins., breadth 19 ft., depth 9 ft. 1 in., powered with a Bolinder engine of 80 h.p., with two cylinders, which gives her a speed of seven knots loaded. This, like many other good boat, was built in England in 1914, in which year she came to Hudson's Bay. Here, again, the oil-engined boat comes to the fore, as she replaced the steamer which superseded the sail boat. The boat was specially built to the designs of the Hudson's Bay Co. for use in the bay, and up to date has proved very satisfactory, which is undoubtedly due to the oil engines. The writer has mentioned before in "The Motor Ship and Motor Boat" that the boat powered with an oil engine

is the only one for use in the frozen far North.

A Stormy First Voyage

Shortly after the schooner had been floated at Port Nelson the captain arrived, so she left for York Factory, her headquarters, which, in the early history of Hudson's Bay, was known as Fort York, hence the schooner's name. Since the advent of the Hudson's Bay Co., it has always been the custom to fire a salute when a ship first arrives, so we had a good reception. At York the boat was tied up to the wharf until such time as would allow her to proceed to Fort Severn with supplies. In due course the boat loaded for Severn, some 190 miles from York, which took us 60 hours. On the trip terrible weather was experienced. Apart from the skipper, mate, and engineer, the crew are Indians, originally the red skins, and all aboard were very sick, the cook included, who we never saw till our arrival at Severn. In 24 hours' steaming at full aheard we only made 14 miles. During this time the propeller was continually in and out of the sea, yet the Bolinder ran steadily, and kept up to its work. Like York Factory, Fort Severn is very historic, and the stockades used in the early days for protection exist to this day. The arrival of the schooner at any post is always a big time with the natives, no matter whether Indians or Eskimo, and it is the usual custom for a dance to take place, all parties taking a hand, so at night we had many whilst there, much to the Indian belles' delight. One fine morning at Severn much gunfire was heard, the result being numerous seals, for the Indians in various canoes were hunting them.

Seal and Whale Hunting

Eventually the schooner left Severn for headquarters, but this time we had better weather, and made the trip in 34 hours. After being at York some days we proceeded to Fort Churchill. At this place a bush fire was to be seen, which lasted over a week, and was certainly a glorious sight. At Churchill we had to wait till the arrival of the ice breaker with supplies. In the meantime the mate and the writer visited the well-preserved ruins of "Fort Prince of Wales. It was very interesting to see the names with dates of various people who have chiselled them into the huge stone blocks. We also had good sport fishing, and seal and white whale hunting. The seal, being the common hair variety, are only fit for dog food. One of the numerous white whales shot by the mate had a length of 15 ft. 6 ins. and a girth of 7 ft. 2 ins., its weight being 1,520 lbs. The mate, being on the hungry side, exchanged one with the Eskimos for a few ducks, which were much appreciated. I may add that it was not long before the Huskies hoisted the sail in their boat and fetched the mammal, which they immediately rendered down for oil, this being their only source of fuel and light in the long winter months.

The supply ship arrived, and the schooner was loaded with supplies for this district, which she discharged at York. In the meantime the ice breaker at Churchill discharged her cargo into the warehouse, at which place we loaded the schooner. After a few trips more from Churchill with supplies the season's work was done. Late in September the schooner left York Factory for winter quarters until next season.

A.L.P.C.

Courtesy of "Motor Boat"

INCREASED USE OF MOTOR TUGS

The following extract from Lloyd's List Weekly Summary illustrates very forcibly the growing utility of the internal combustion engine. Day by day brings fresh evidence of the development of this type of motive power, and it is interesting to follow its gradual adoption into all classes of vessels. The correspondent of Lloyd's List says:

The satisfactory results which have been achieved with the relatively small number of motor tugs now in service have induced tug owners, both in this country and on the Continent, to place further orders, and, although these are not on a large scale, there are evidences that sooner or later there will be a general demand for motor tugs instead of those equipped with steam machinery. An interesting feature of this development is that not only are tugs being ordered for ordinary river and harbour work, but larger sea-going craft are also under construction.

In Holland a couple of sea-going tugs equipped with Sulzer engines of 420 b.h.p. have just completed their trials. These are similar in many respects to five vessels equipped with machinery of the same class put into commission on the Seine a short time ago. In Sweden a sea-going tug fitted with a 500-h.p. Polar two-cycle engine is being built, while there are one or two vessels of equal power now under construction in this country.

Among the smaller craft that have recently been put into service are some that were designed originally for war purposes. These are 50-ft. vessels, built at Wivenhoe by Messrs. Cox & King. The machinery installation of the first few of these vessels was somewhat interesting, although uneconomical to operate. They comprised a 220 b.h.p. Standard petrol engine of the double-acting direct reversible type, as installed in the British submarine-chasers known as the M. L.'s. The reason that these engines were installed was that they were available, and at the time they were designed the cost of operation was not a matter of any importance, in view of the urgency of the completion of the vessels.

In the later vessels, however, paraffin motors have been installed, a single six-cylinder engine of 75 b.h.p. being fitted in these craft. This motor is of the Djinn type, a heavy class of electric-ignition paraffin motor, running at about 500 r.p.m., and therefore fairly suitable for towing work. It must be admitted, however, that for the larger class of tug a hot-bulb or Diesel engine represents a more satisfactory proposition.

In the 50-ft. craft designed to stand moderate weather a cabin was arranged aft of the engine-room, which was situated amidships. The steering position is slightly forward of amidships, and as there is no funnel the helmsman has an unobstructed view of fore and aft, an advantage of some importance which is common to all motor tugs in which no funnel is fitted.

CONVERTING STEAMERS TO MOTOR SHIPS

The coal situation has now reached a point in Europe that it is possible, notwithstanding the heavy expense and loss of time entailed, to profitably convert steamers into motor ships. In Sweden, where the cost of coal has reached the neighborhood of $70 a ton, besides being difficult to obtain, one of the large shipowning firms has decided to convert their fleet to motor ships. This firm is the Rederiaktiebolag Transatlantic, of Gothenburg, and they have commenced the conversion of one of their vessels, the "Bolmen." This vessel was built on the Clyde, and is of about 5,000 tons d.w. She has at present a triple expansion engine of 1,500 I.H.P., and this will be replaced by a two-cycle engine of the Polar type, developing about 1,700 I.H.P. The old propellor and shafting will be retained, and the new engine will run at about 90 revolutions. The added capacity for cargo, due to the saving in space, will be about 10 per cent., and the consumption of oil will be about 6 tons per day as against 25 tons of coal with the present machinery. The auxiliary will be electrically driven, power being supplied by direct connected Diesel engines and dynamoes, of which there will be three of 60 h.p. each. The saving is estimated to be such that the total cost of the conversion will be wiped out in about eighteen months.

LAUNCH FROM TORONTO YARD.

The steamer "Gonzales" was successfully launched from the yard of the Dominion Shipbuilding Company, Toronto, June 19th. The "Gonzales" is a single screw steel steamer of 261 feet over all, fitted with triple expansion engines and Scotch type boilers. She is owned by the Gulf Navigation Co., of New Orleans, U.S.A., and a second steamer for the same owners occupies the adjoining berth in the yard. There are four hulls on berths at the Dmoinion Company's yard, in various stages, including two of the Canadian Government contracts.

The General Survey of Engines and Boilers

This Article Deals in a Descriptive Manner With the Work Necessary to Put a Ship's Engine Through Lloyd's or Board of Trade Survey

By T. H. FENNER

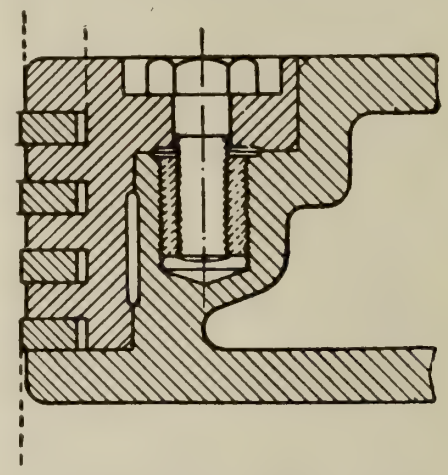
THE examining of cylinders, pistons, and valves, usually known in seagoing parlance as overhauling, the tops, is as a rule performed by the second engineer, assisted of course by a couple of firemen.

The work consists of raising the covers, examining, and, if necessary drawing the pistons, examining and checking the setting of the valves, touching up valve faces if required, setting piston springs, etc. The second engineer takes charge of this work for the same reason that he takes charge of the work on the boilers, because the good condition of these parts is a vital necessity and because they cannot be touched when the ship is at sea without incurring a long and perhaps hazardous stop. This of course does not imply that second engineers are infallible. but that their position as engine room executives naturally includes the more important jobs.

Lifting the Covers

For the purpose of raising the cylinder covers, which are of course very heavy, especially the low and intermediate, a beam is built into the ship's plating, running fore and aft the engine room, and directly over the centre line of the engines. A small trolley runs on this, and from the trolley a gooseneck is hung. Into this is screwed a long bolt having a square thread made on it, and on the other end of this is a swivel carrying a hook.

When a cover is to be lifted it is first started, after the nuts are all off, by screwing down two small tap bolts which are placed in the flange for that purpose. Sometimes small wedges are used for the same job, and even a chisel occasionally, but this practice leads to badly knocked about covers and gives a sloppy appearance to the job. The starting bolts should always be in their place and always used. A cylinder cover is usually very easy to start, the main thing being to keep it even on the studs all around while raising it. The covers are usually made steamtight with a joint of asbestos tape laid around inside the studs on the cylinder. If this joint has been well rubbed (on the face touching the cover) with graphite, or black lead and tallow, it will not adhere to the cover when that is being raised. The cover having been slacked off and started, eyebolts are screwed into the tapped holes in the cover, and chain slings put through them and on the hook of the stretching screw already mentioned. This screw is swelled out near the bottom end and holes provided for inserting the podgers of pinch bars by which it is turned round. When lifted clear of the studs, the cover is run along by means of the trolley and landed on the cylinders adjacent. If it is the high-pressure cover we are working on it will be run aft and landed on top of the intermediate cylinder or between the intermediate and low on a convenient place. It will be landed on to wooden blocks placed so as to support the cover under the flange and high enough to keep the spigot of the cover clear of the place the cover is resting on. This ensures solidity, and as the lifting screw will be required for other work while the cover is still off, this precaution is necessary. When moving heavy weights aboard ship, and leaving them in temporary positions, whether the ship is in dock or river, or open harbor, always make certain that they are so blocked off that they cannot move. The ship being in dock may apepar as still as a house, but she may move when least



TYPICAL MERCHANT SERVICE PISTON

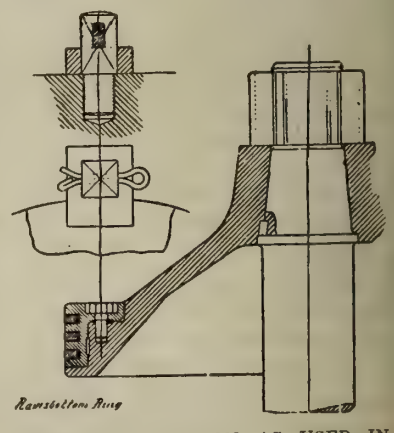
expected. Another vessel may come alongside with a jar; the wind may cause a slight movement; pumping out or filling tanks may cause a list to appear. If your cover is placed in a position where it is capable of sliding, you may go away at night feeling happy, and come back in the morning to find something badly smashed. If the lifting screw is not otherwise engaged, it is a good plan to hook the slings of the cover up to it and just tighten them enough to straighten them out before leaving; you are then as nearly sure as is humanly possible that nothing can happen. These precautions may seem to some to be a waste of time, but it is the little precautions that save the big smash. Never take anything around a ship's engines for granted. Make sure, no matter how much trouble is entailed.

The H. P. Piston

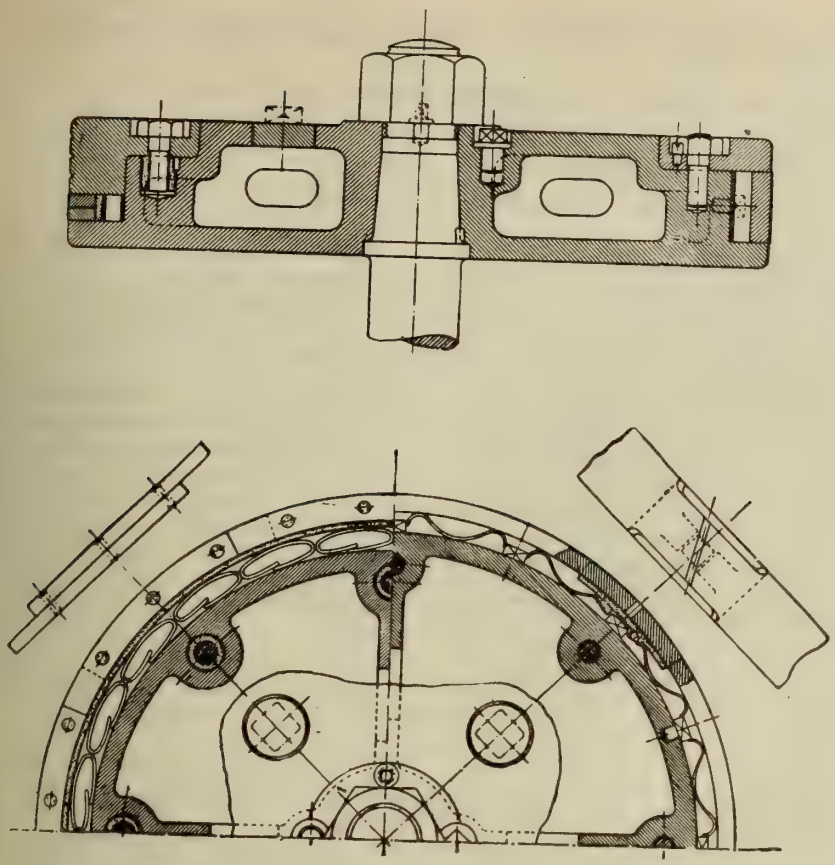
Having got the cover lifted and safely placed, the high-pressure crank will be turned to the top centre so as to bring the piston in reach. Here again the first step to take is one of caution, and is to place in the cylinder steam ports coarse bagigng, well packed in. This is to prevent any tools or nuts and bolts, etc., from inadvertantly dropping into the port, from whence they would later emerge, either on to the valve face or into the cylinder. Whichever of these outlets the bolt, heisel or what not found, it would be very likely to cause very serious damage. The tucking in of a bit of bagging effectually blocks the port and saves all fear of this.

On the type of piston fitted will depend whether it has to be drawn to examine the rings or if the rings can be withdrawn without the piston. High pressure pistons are usually fitted with Ramsbottom rings, and if of small sizes the grooves for the rings are turned directly on the body of the piston. However, in later practice or with larger H. P. pistons, the plan is to make the junk ring with a spigot and turn the grooves for the rings in this. By taking out the junk ring bolts, the packing rings and junk ring can be withdrawn in its entirety. Supposing, however, that the piston has to be drawn to examine the cylinder below it. Here again the method of construction will determine what is needed. In larger sizes of engines the piston rod is tapered and fitted into a taper in the crosshead, with a nut on the end of the rod. In smaller engines the cross head is forged directly on the rod. In the first case the nut is taken off the crosshead and piston and rod drawn together. In the latter case the piston must be drawn from the rod.

In stripping a cylinder cover, junk ring, or an ypart of an engine secured by nuts and bolts, or studs, certain methods must be followed if they are to be put together with a minimum amount of trouble. For instance, when



SECTION OF PISTON AS USED IN ROYAL NAVY.



SECTION OF L.P. PISTON.

taking the nuts from the cylinder cover, the first one taken off should have its stud marked in some manner to identify it. A small centre punch mark in the end of the stud will do very well. A piece of marline or spun yarn, if used to thread the nuts on in order as they are taken off, and when they are put back, the last one off will be the first one to put on, and they will be put on the studs in the opposite order of rotation. If studs and nuts were made to standard gauges, this care would not be necessary, but anyone who has had to replace nuts on bolts and studs knows the time wasted if they get mixed. In the case of the junk ring tap bolts, these are numbered, and a corresponding number typed on the body of the piston opposite the bolt hole. Junk ring bolts are generally made of gunmetal, and in many cases are screwed into a gunmetal plug. This plug is screwed into the body of the piston with a fine thread and screwed by gagging or doweling. The object of using the gunmetal plug is to prevent the bolts rising in the body of the piston. In the case of a small piston with the grooves turned direct in the body of the piston there will be no junk ring fitted. The pistons in the merchant service are generally of cast iron, while in the navy the practice was to make them of cast steel, and conical form. This made a very light, and at the same time strong piston.

The piston is fitted on to the rod with a taper, and the piston rod nut is fitted with a guard to prevent the nut becoming slack. This guard assumes various forms, in some cases the nut being castellated, and a cotter, secured with a split pin passed through the end. In others a sheet iron guard is placed over the nut made with a lug, and a setscrew is screwed into the piston, passing through this lug. Another method is to screw a setscrew through the side of the nut into the end of the rod, and another device is to drill a hole through nut and rod, making it taper with a reamer, and fitting a tapered pin after the nut has been tightened up. The best method is the castellated nut as it allows of the locking device being entered if the nut in time goes further round owing to wear. With the other devices it becomes necessary to put a washer under the nut if wear takes place, and it is then difficult to get the exact thickness of washer required.

Drawing the piston entails very often a good deal of trouble. The piston rod nut is first slacked back with a special spanner and a 14-pound hammer. It may be necessary to heat the nut before it will start, and this is advisable if it shows strong resistance to the blows of the hammer. The end of the rod where the thread starts is a weak spot, and continued hammering on the end of a spaner produces a very heavy repeated stress, which may result in fracture or heavy strain, which will result in a break later. Having succeeded in getting the nut off, the next thing is to procure the bolts made and supplied by the maker for the purpose of drawing the piston. Tow holes, of about 1-inch diameter are provided in the piston body near the hub, and the studs are screwed into these. They are long enough to allow of a strong back being passed over them, resting on the end of the rod, and nuts are then placed on them and screwed down. Another and better way is to use two strong backs placed across the cylinder top. This allows the end of the rod to be free, and when a strain is placed on the nuts and all the slack taken up, a few sharp blows on a piece of copper placed on the end of the rod will often succeed in starting the piston. The copper of course is to protect the rod. Drawing the piston by means of eyebolts and the stretching screw is not to be recommended as there is too much spring in the various parts, and the difficulty of getting a fair lead makes bending of the bolts very easy. It is a case of using patience, common sense, and a judicious amount of force. A good dose of coal oil round the hub of the piston, left for a time to find its way around the taper is a great help. Remember the piston was meant to be detachable, and do not lose patience and resort to strong arm methods, which are rarely successful.

(To be continued)

SEES BIG FUTURE FOR THE YARDS HERE

Sir James McKechnie Optimistic on Chances of Shipbuilding in Canada

In the group of gentlemen interested in the proposed merger who were to be seen at the Ritz-Carlton, Montreal, a prominent figure was Sir James McKechnie, K.B.E. Sir James is managing director of Vickers, Limited, at Barrow-in-Furness, England, and is considered one of the foremost engineers and marine architects in the world. To the Gazette representative, he stated:

"I have just returned from an inspection trip of the shipbuilding plants proposed to be absorbed in the British Empire Steel Corporation. I am surprised at their magnitude, and also at the economical layout of the plants, and I have seen the most modern machinery in these plants that exists anywhere today, and for the first time in my life I am ready to admit that there is a great future for the shipbuilding industry in Canada.

"I have no hesitation in saying that the acquisition of the companies owning these plants is absolutely essential, in my opinion, to the existence of the British Empire Steel Corporation. It will only be following out the same lines as have been adopted by the United tSates Stetel Corporation and our big steel interests in England, where they have control of their shipping and shipbuilding plants."

The burial took place at St. Catharines, Ont., of Captain John Dewey, a lifelong resident of St. Catharines, and a noted Canadian marine engineer. He died at the home of his daughter, Mrs. Thomas Welch, at Buffalo.

Experience and Practice With Reduction Gears

A Review of the Experience with Mechanical Reduction Gears as Used in the British Navy—Paper Read Before the Institution of Naval Architects.

By ENGINEER COMMANDER H. B. TOSTEVIN, D.S.O., R.N.

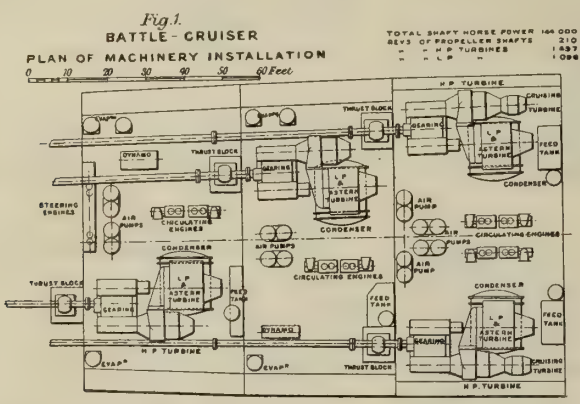
THE most important change in the steam machinery of warships of high speed and power during the war period was the departure from the direct-drive turbine installation to that in which the power of the turbines was transmitted to the propeller shaft through mechanical reduction gearing, and it is the object of the present paper to trace briefly this development and indicate the experience that has been gained and also the general practice of the Admiralty as regards the details of these gears Before the actual adoption of gearing it had long been recognised that some form of reduction device was necessary in order that the turbines and propellors should run at speeds which secure their best efficiencies, and all designs with the direct drive installations had been of the nature of a compromise in which the maximum efficiencies of both turbines and propellors had been sacrificed in order to obtain the best overall results to meet the nature of the particular case. There were three practical methods of obtaining this reduction, viz., hydraulic, electrical, and mechanical, each possessing its peculiar merits, and in the early history it is noteworthy that the first two were more seriously considered than the third, as they did not at the time offer such difficulties in the way of manufacture and reliable transmission of high power. At the present stage in British naval practice the first two methods have not been tried, at least in connection with high power steam machinery.

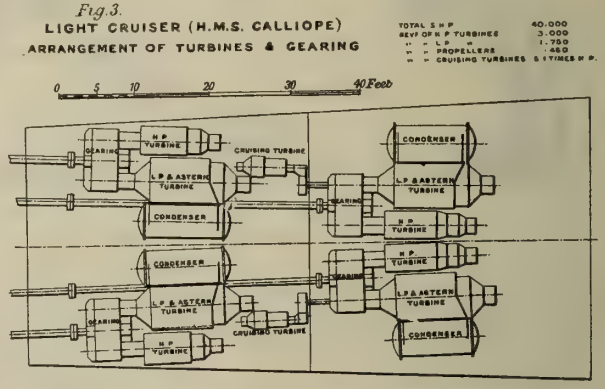
Whatever method is adopted a loss must occur between the turbines and the propellor shaft from various causes, which need not be gone into here. Experiments have shown that with the best design of the respective devices, the losses in transmission may be approximately taken as: hydraulic, 10 per cent.; electrical, 8 per cent.; mechanical gearing, 1½ per cent. If double reduction gear were fitted the loss with mechanical gear would be about 3 per cent.

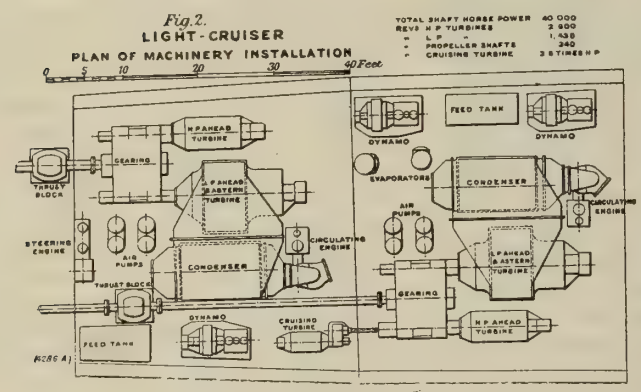
The superior efficiency of the mechanical method has been an important factor in reaching a decision as to the type of reduction device to be adopted for naval use, and when it is combined with considerations of simplicity and reliability and the very small cost of upkeep, the combination has been considered up to the present to outweigh the advantages possessed by the other forms of transmission, such as the absence of astern turbines, and the possible maintenance of a higher turbine speed and efficiency at crusing speeds. With the design of turbine as now developed, in which special arrangements are made to permit it to maintain its efficiency to a marked extent as the speed of revolution falls, this latter advantage is to a certain extent discounted.

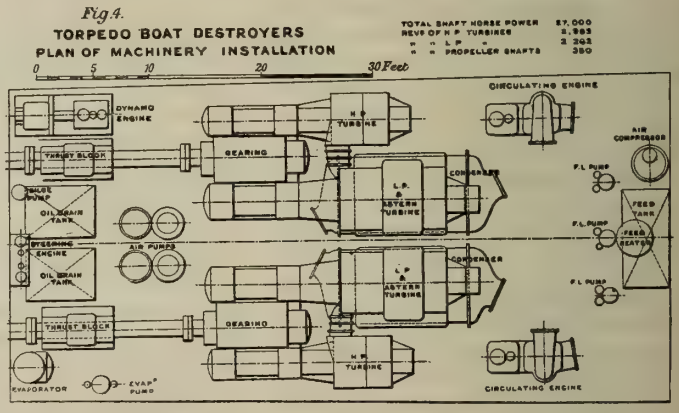
The endurance and reliability which are features of turbine installation are even more pronounced when geared turbines are fitted, because of the smaller and more rigid structures and moving parts. Also the larger and more efficient propellers improve the manoeuvring power, and in particular the stopping effect is increased by the ease with which the larger propellers get a hold on the water. The necessary astern power (which in most warships is approximately one-third of the ahead power) can be obtained on a single velocity-compounded turbine wheel without working the boilers to full power. The smaller turbines and their more substantial construction render them less liable to distortion troubles than is the case with the larger direct-connected units.

To trace the development of mechanical gearing for marine purposes one need go back no further than 1910,* when Sir Charles Parsons, who was desirous of applying the steam turbine to vessels of moderate and low speed, car-









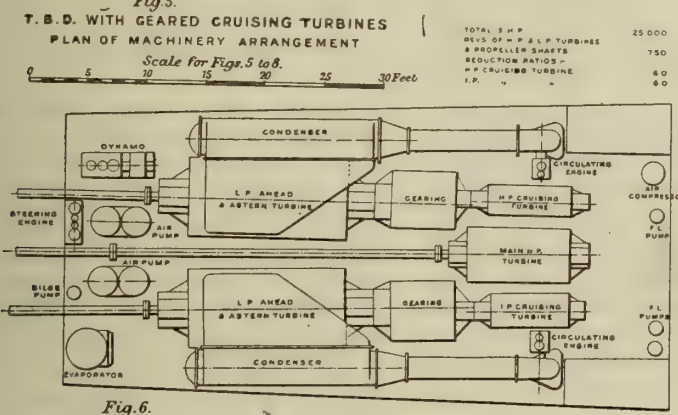
ENGINE ROOM ARRANGEMENTS.

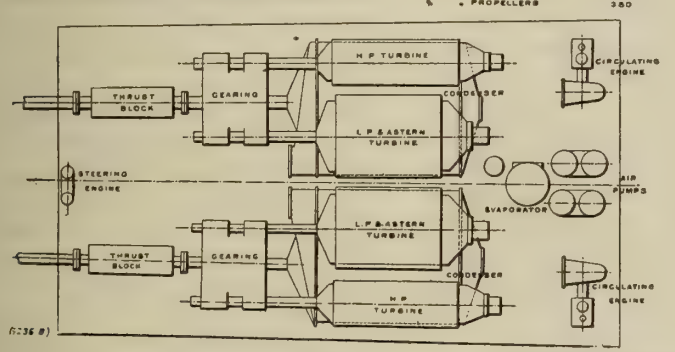
ried out his experiments in the Vespasian, an old cargo steamer, experiments which have proved to be epoch-making. The success of these experiments, which were dealt with in a paper read before this institution in 1910,* indicated that increased efficiency could also be obtained by means of reduction gearing in ships of the classes from which the reciprocating engine had been definitely displayed by the turbine. The Admiralty made its first step in 1910, and in two torpedo-boat destroyers of that year's programme, the Badger and Beaver, gearing was fitted for part of the main turbine installations. The low-pressure turbines drove the shafts direct, but on a forward extension of their rotor spindles gear wheels were fitted which were driven through pinions by the small fast-running cruising and high-pressure turbines. The maximum horse-power transmitted through each set of gearing was about 3,000. Before these vessels were completed a further advance was made, and in 1912 it was arranged, in two torpedo-boat destroyers, the Leonidas and Lucifer, of 22,500 h.p., for the whole power to be transmitted through two sets of gearing. The general arrangement as regards the component parts of an all-geared set adopted in these vessels has been adhered to in naval practice to the present day, viz., each set of gearing is driven by two pinions, driven respectively by the high-pressure and low-pressure turbine. In some installations an additional turbine for cruising has been fitted on an extension of the high-pressure spindle.

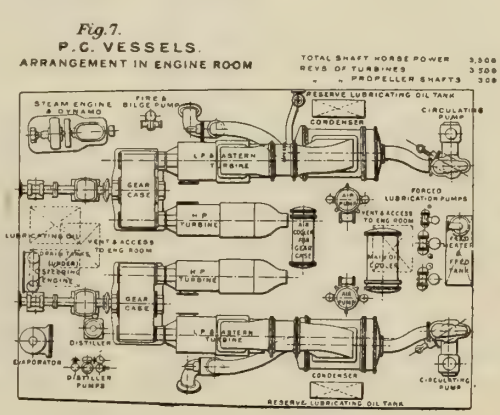
On completion of the Leonidas in 1914 exhaustive trials were carried out, and the results obtained as regards the efficiency of the machinery installation at all powers were very satisfactory and superior to any that had been obtained with direct drive units. Both vessels were hurriedly put into commission in August, 1914, when experience with the running of high-powered gears was practically nil. The installations received a very severe test on service, as both boats were in commission right through the war, for the first two years being attached to the hard-worked Harwich force. Their successful running speaks volumes for the manner in which several recognized difficulties connected with the application of mechanical reduction gears for high powers had been so quickly recognized and overcome.

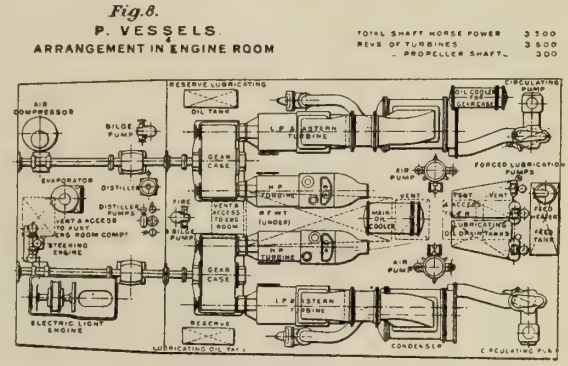
Before the completion of the Leonidas and Lucifer, two light cruisers of 40,000 h.p., viz., Calliope and Champion, were arranged to have all-geared units, but the former vessel was fitted with four shafts, and the latter with two, so it is seen that in the course of three years from the adoption of reduction gearing, and in the third order of warship so fitted, a figure of 20,000 h.p. through one set of gearing was reached. This installation ran satisfactorily on service, and as a result it was recognized that mechanical gears were suitable for the higher power required on a single propeller shaft.

The all-geared installations were not at once universally adopted for the vessels ordered on the earlier war programmes, the policy in the emergency of adhering to the direct drive type of turbine, which for several years had proved its efficiency and reliability, being followed for some time. The subject of gearing was, however, by no means ignored, and all warships ordered were fitted with cruising turbines, which were geared to the direct-drive units. Clutches were arranged to disengage these gears when running at high powers, although this procedure was not absolutely necessary. A marked gain in economy within the limits of power of the cruising turbines, and a consequent increase in the radius of action was obtained. It should also be understood that at this time the number of special "hobbing" machines required for cutting the teeth of these gears was very limited, and it would not have been possible at the time to have fitted all the war vessels ordered with the all-geared type of installations. By 1916, however, it was considered that sufficient progress had been made to warrant the complete change over, and in practically all fast warships, viz., battle cruisers (a number of which were subsequently not proceeded with) designed to transmit 36,000 h.p. through each set of gearing, light cruisers, flotilla leaders, torpedo-boat destroyers, "K" Class submarines, and "P" boats, the all-geared installation was adopted. Only in the case of a few special destroyers was the direct drive adhered to.









ENGINE ROOM ARRANGEMENTS.

*Trans. I.N.A., Vol. ii., page 168.

The following table shows the total horse-power and number of all-geared sets fitted and being fitted in warships:

Type of Vessel	S.H.P.	Number of Shafts.	S.H.P. per Gearing Set	Total Number of Gears.	Total S.H.P.
Battle cruiser .	144,000	4	36,000	4	144,000
Light cruisers.	40,000 to 80,000	2 or 4	10,000 to 20,000	90	1,760,000
Flotilla leaders .	4,000	2	20,000	26	520,000
Torpedo-boat destroyers ..	27,000 to 30,000	2	13,500 to 15,000	368	5,000,000
"K" Class submarines .	10,000	2	5,000	36	180,000

TABLE I.—SHOWING PARTICULARS OF GEARING IN TYPICAL VESSELS.

—		Battle Cruiser.	Light Cruisers			Torpedo-boat Destroyers.				"K" Boat.	"P" Boat.	Flotilla Leader (Geared Cruisers). Nimrod.	
		Hood	Dance.	Dauntless.	Calypso.	Seafire.	Romola.	Trinidad.	Leonidas.			H.P.C.	I.P.C.
Horse-power	H.P.	17,500	8,600	10,000	8,000	6,250	6,250	6,250	5,150	2,250	875	1,250	3,580
	L.P.	18,500	11,400	10,000	12,000	7,250	7,250	7,250	6,100	2,750	875	—	—
Revolutions per minute	H.P.	1,497	2,568	1,800	2,662	2,985	2,970	3,000	3,340	3,300	3,500	2,380	2,850
	L.P.	1,098	1,403	1,800	1,435	2,262	2,270	2,290	1,815	3,000	3,500	—	—
	Propeller shaft	210	275	275	340	350	350	350	380	380	300	342	483
Pitch circle diameter, in inches	H.P. pinion	20·174	11·755	15·319	10·728	10·0694	10·1283	10·101	9·603	6·7526	4·60	6·018	8·111
	L.P. pinion	27·51	21·514	15·319	19·886	13·2830	13·2447	13·2176	17·648	7·5316	4·60	—	—
	Gear-wheel	143·787	109·789	99·897	83·991	85·9114	85·961	85·988	84·348	58·9552	53·862	41·864	48·405
Addendum of teeth, inches		0·266	0·1855	0·1855	0·12	0·12	0·12	(0·284 Pinion / 0·048 Wheel)	0·1855	0·12	0·168	0·1855	0·1855
Number of teeth	H.P. pinion	55	53	71	41	47	39	39	37	26	24	23	31
	L.P. pinion	75	97	71	76	62	51	51	68	29	24	—	—
	Gear-wheel	392	495	463	321	401	331	332	325	227	281	160	185
Pitch, in inches	Normal	0·99847	0·583	0·583	0·583	0·583	0·583	0·583	0·583	0·583	0·5196	0·583	0·583
	Circular	1·153319	0·69679	0·67783	0·8220	0·6730	0·815875	0·8156	0·8153	0·8158	0·600	0·822	0·822
	Axial	2·002	1·06	1·4285	0·8275	1·16	0·835	0·836	0·834	0·835	1·04	0·822	0·822
Helical angle		29° 57′	33° 12·4′	30° 40·3′	44° 49·8′	29° 58·9′	44° 23·6′	44° 25′	44° 22′	44° 23·6′	30°	44° 49·8′	44° 49·8′
Tooth angle	Normal	14° 28·7′	14° 29·5′	14°29·5′	14° 29·5′	14° 29·5′	14° 29·5′	14° 29·5′	14° 29·7′	14° 29·5′	17° 30′	14° 29·5′	14° 29·5′
	Circular	16° 36′	17° 12′	16° 44′	20° 2·5′	16° 37·5′	19° 57′	19° 55′	19° 56′	19° 57′	20°	20° 6′	20° 6′
Width of pinion face, in inches	Total	75	53	60	54	40	40	40	·29	28	·21	24	35
	Effective	73·25	51·25	58·25	52·6	38·25	39·5	38·6	27·6	26·9	20·5	24	35
Number of teeth engaging		36·60	48·3	51·7	63·5	33·0	46·7	46·2	33·1	32·2	19·71	29·2	42·6
Length of tooth contact, in inches, per tooth	H.P.	3·525	2·125	2·38	0·94	1·58	0·97	1·21	1·46	0·9625	1·79	1·337	1·39
	L.P.	3·63	2·185	2·38	0·94	1·58	0·97	1·21	1·51	0·9625	1·79	—	—
Total length of contact, in inches	H.P.	128·8	103·3	123·0	59·7	52·2	45·3	55·9	48·4	31·0	35·30	39·08	59·2
	L.P.	132·9	105·5	123·0	61·3	52·2	45·3	55·9	49·9	31·0	35·30	—	—
Tangential load, in lb.	H.P.	73,000	35,850	45,700	35,200	26,200	26,200	26,200	20,300	12,700	6,840	11,000	19,500
	L.P.	77,200	47,500	45,700	53,000	30,500	30,500	30,500	24,040	15,400	6,840	—	—
Normal load, in lb.	H.P.	87,000	44,400	55,000	51,500	31,300	38,000	38,100	29,350	18,400	8,300	16,150	28,600
	L.P.	92,600	58,700	55,000	77,500	36,300	44,000	44,100	34,800	22,300	8,300	—	—
Load in lb. per inch, tooth length of contact	H.P.	675	430	449	871	600	838	681	606	594	234	413	483
	L.P.	697	556	449	1,260	695	970	790	697	720	234	—	—
Load, per inch, on total width of tooth face in lb. (= P)	H.P.	965	677·5	762	650	655	655	655	701	453	325	458	557
	L.P.	1,030	896·0	762	980	760	760	760	830	550	325	—	—
K in formula $P = K\sqrt{P.C.D.}$	H.P.	215	197·5	195	198	206	207	206	226	174	152	187	196
	L.P.	198	193·0	195	220	208	207	208	198	200	152	—	—
Speed of teeth at pitch line in f.s.		132	132	120·4	124·8	131	131	131	140	97·6	70·0	62·5	101
Maximum rubbing velocity of teeth in f.s.	H.P.	11·5	14·6	10·5	8·5	11·5	8·9	18·9	9·5	11·0	15·5	12·1	14·5
	L.P.	9·5	8·3	10·5	4·9	7·2	6·2	14·4	16·9	11·0	15·5	—	—
Stress at root, in lb. per sq. in.	H.P.	3,040	3,530	3,340	5,850	4,150	5,680	—	4,980	4,000	1,900	3,900	4,740
	L.P.	3,140	4,580	3,540	8,500	4,820	6,680	—	5,720	4,850	1,900	—	—

"P" an "P.C." boats	3,500	2	1,750	128	224,000
Totals	.....	..	.....	652	7,828,000

Of this number 596 gears are, or have been, on service, representing 6,794,000 shaft horse-power. The 36,000 shaft horse-power sets have not yet been on service, but have run at approximately full power for a short period. In addition there are a large number of sets of gears fitted in conjunction with cruising turbines, or as part installations, but as these gears, owing to the exigencies of war and other conditions, have not been used to their full extent, they are not included in the list. The arrangements of turbines and gearing in typical vessels are shown on page 147.

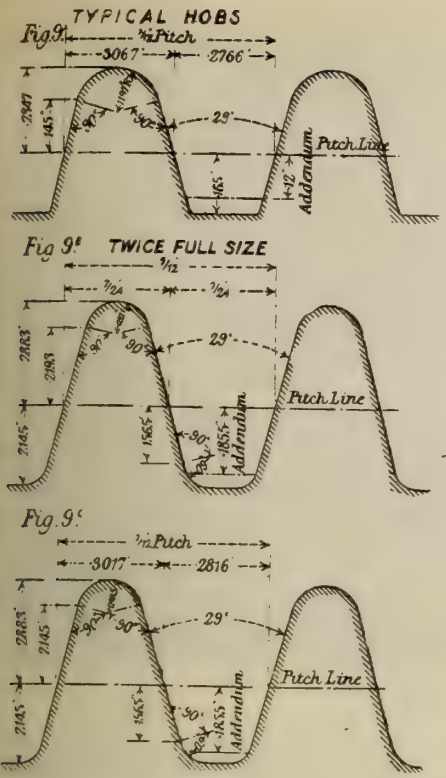
In straight-cut gears the small number of teeth in contact, viz., one or two, imposes a limit to the speed at which high powers can be smoothly or safely transmitted, and for transmitting high power, helical gear, i.e., toothed wheels in which the teeth are inclined to the axes of the wheels, is necessary. All the gearing now in use in warships is of the double helical type, a right and left-hand helix being used to balance the axial thrust entailed. The involute tooth form is invariably used, as it possesses essential advantages over other forms, the most important of which are: (1) The teeth can be generated automatically in a machine by a straight-sided cutting tool, which can be made and ground very accurately. (2) A variation in distance between the centres of pinion and wheel (and such variations occur in marine practice owing to the necessity for ample clearance in the high-speed bearings, and also possibly with misalignment and wear of bearings) does not affect the velocity ratio of the wheel and pinion or the smooth working of the teeth.

In the early days of turbine gearing there was not much experience available bearing on helical gearing for comparatively high powers, and in the first designs the gears were arranged with a helical angle of 20 deg. in conjunction with a pitch normal to the line of the teeth of ¾ in. This design was rather noisy, and in consequence the angle in succeeding designs was increased to about 45 deg., which value was known to have proved satisfactory in De Laval installations of small power. The 45-deg. design was continued until recently with generally satisfactory results, but in the meantime, with the improvements in gear-cutting processes, it had gradually been established that the noise and tremor experienced in the early installations was more due to irregularities in cutting than to the small helical angle itself. An angle of 30 deg., which possesses advantages in the way of efficiency and tooth strength, in that the contact between the teeth is increased as compared with 45 deg., while the normal load on the teeth is decreased, has now been generally adopted by the Admiralty. This angle is rarely an exact number of degrees, as it is affected by the driving and change-wheel mechanism of the hobbing machine, but is as near the desired angle as these details allow. Fig. 16, page 482, shows a set of gear wheels and pinions cut to an angle of 32 deg.

The angle of obliquity used is 14½ deg., in agreement with the almost universal commercial standard developed for spur gearing with involute teeth. There is no particular virtue in this angle within limits, and the odd ½ deg., it is understood, was decided by the fact that sine 14½ deg. being 0.250, calculations were simplified.

Fine-pitched gears give more silent running at high speeds, and a normal pitch of 7-12 in has been adopted for all but the very largest installations. While the pitch and obliquity have remained the same, the proportion between addendum, dedendum and pitch respectively and the shape of the root and tip have been changed from time to time as experience of the successive designs was gained. Fig. 9, page 145, illustrates stages of the transition, it being noted that the form of cutting tool is shown, and that while the height and normal pitch of the actual tooth generated will be the same as for the hob, the thickness and contour of the teeth will depend upon the pitch circle diameter and upon the hob design. The earliest design of hob (which is not shown) produced a form which gave at the base of tooth only a small radius, and it was at a very early stage modified to provide a more pronounced radius at the tooth root. In the design in Figs. 9B and 9C the rounding of the tips of the teeth was introduced to overcome the "digging in," and excessive wear of the tips which had been observed in some designs, probably due to the failure of the oil film on the surface at this position.

The question of the lubrication of the teeth is very important, and while running, an ample amount of oil, which is generally injected from nozzles on to the line of contact of the teeth, is necessary. It is usual to arrange ¼-in. to 3-8-in. nozzles of about 5 in. pitch, discharging the oil under a pressure of from 5 lb. to 10 lb., the jet being fan-shaped, so that the whole length of the teeth is lubricated. In early practice nozzles were fitted to discharge to the line of contact both on the entering side when running ahead and also when running astern, but the latter groups are not now fitted as experience shows they are not required considering the short periods of astern working usual in naval vessels.



Figs. 11 and 12 show a type of sprayer fitted, together with its arrangement on the gear-case.

The teeth of gearing engage by line contact, but it must be appreciated that contact under a load can no more occur on a line than the load on a ball bearing can occur on a number of geometrical points. Elastic deformation of the surfaces must take place under the load, and the momentary flattening leads in each case to a surface contact. Owing to the lubrication, however, the load that can be safely sustained between two sliding surfaces in contact is decided by the pressure in the oil film between them and by the area of the film. Modern developments in the theory of lubrication seem to show that the pressure in an oil film between two surfaces varies as the thickness of the film and that beyond a certain thickness of film no pressure is maintained. For a given thickness of film it will extend over an area practically proportional to the square root of the radius of curvature of the surface and this area may be regarded as the virtual area of tooth contact. The radius of curvature may be taken on the pinion teeth alone, as the gear-wheel teeth are sensibly flat, and as this average radius of curvature of the tooth form varies as the pitch diameter of the pinion, an empirical rule depending to a certain extent on the helical angle for the allowable tooth pressure $p = K \sqrt{D}$, where K is constant, is obtained, p being the intensity of pressure in pounds per inch of axial length. The values of K for a large number of cases are shown in Table I, and are seen to be round about 200 to 225 in the majority of cases. The pressures obtained per inch width of face are also shown, and vary from 700 to 1,030 in the high-powered installations at the nominal full power.

Table I and Fig. 10 illustrate these points in typical cases.

A difficulty in the early history of gear-cutting was caused by the fact that the master worm wheel which rotated the gear wheel during the cutting operation was not quite accurate; this difficulty led to an addition to the machines of a "creep" mechanism, by means of which the job is rotated at a higher speed than the table. Any recurring error in the worm wheel which might be copied on the job being cut is, with such a machine, no longer in the direction of the axis but is distributed in helices on the gear wheel or pinion. With improvements in the accuracy of this master worm wheel and the maintenance of the machine in good condition with all parts well lubricated during a cutting operation, the advantage derived from the use of the "creep" has been lessened, and from a list of 10 firms that have cut the majority of the naval gears it is a matter of interest that on the wheel machines only four, and on the pinion machines six firms, use "creep." As regards the tendency of the worm wheel to wear out of truth, inquiry has shown that in a number of machines that have been working constantly for at least three years the accuracy has not been affected.

Experience indicates that extreme accuracy of tooth-cutting and the maintenance of accurate alignment are necessary to the successful operation of any mechanical reduction gear. In all naval work the turbine spindles, pinions and gear wheels are supported on rigid bearings, and the alignment is determined by accurate machine work in boring the gear housings and fitting the bearings. No gears of the floating frame type, in which the pinions and bearings are mounted in a frame supported on a flexible I-beam, which automatically maintains its correct position after being accurately aligned in the first place, have been fitted, and judging from the general experience obtained over a number of years it appears that any advantage likely to accrue from the adoption of such a system would be outweighed by its disadvantages. The important feature that must be borne in mind is that in all calculations of tooth stress and dimensions of the surfaces required between the working faces of the teeth, the design and construction should be such that the total tooth pressure is uniformly distributed over the whole width of the tooth face, but various conditions arise in practice which tend to upset this working. Misalignment is one cause, and it emphasises the special care necessary in this particular. In some designs the turbines and gear-cases were carried on separate supports built up from the hull structure. The turbines and gear-cases as separate units are of stiff construction, and under working conditions do not suffer distortion. The possibility of relative motion between the turbines and gear-case existed, and although nearly all vessels so constructed experienced no troubles with the gearing, yet in two torpedo-boat destroyers the gear became very noisy, and wear took place on the teeth. Although no actual breakdown occurred, the defects were objectionable, and the gears were removed for dressing up. When the alignment was again tested it was conclusively proved that relative displacement of the gear-case and turbines had actually taken place. In later designs this movement is not possible, as the after-ends of the turbines are now supported on stiff extensions of the gear-case, the whole installation forming a rigid unit. This is illustrated in Fig. 15.

Owing to the action between the teeth when transmitting power, the pinion and wheel tend to increase their distance between centres. This, as pointed out, does not affect the smooth or regular action of involute teeth, but the line of centres through turbine and pinion should be

Fig.10 DIAGRAM ILLUSTRATING THE RELATION BETWEEN P.C.D. OF PINION AND TOOTH PRESSURE PER INCH WIDTH FOR TYPICAL CASES COMPARED WITH CURVES $p = 200\sqrt{D}$ AND $p = 220\sqrt{D}$.

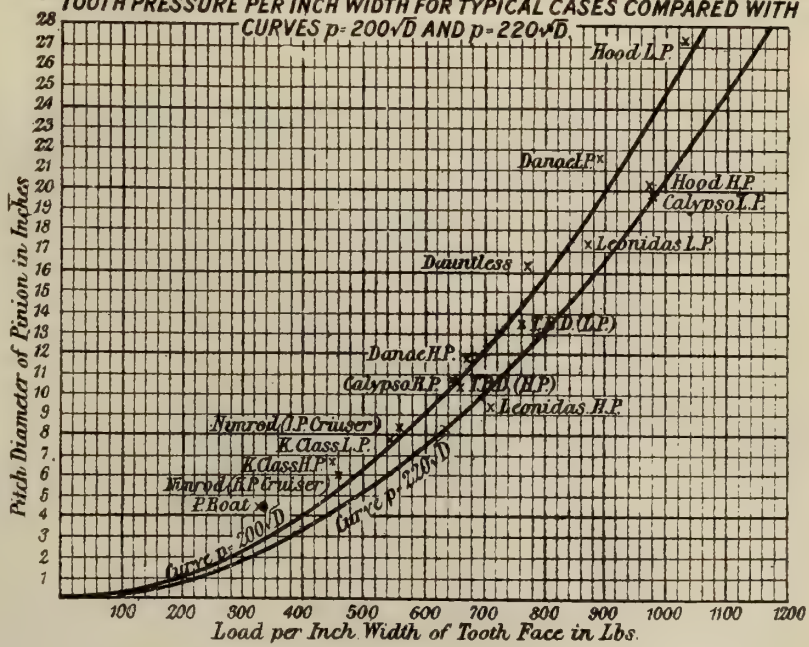
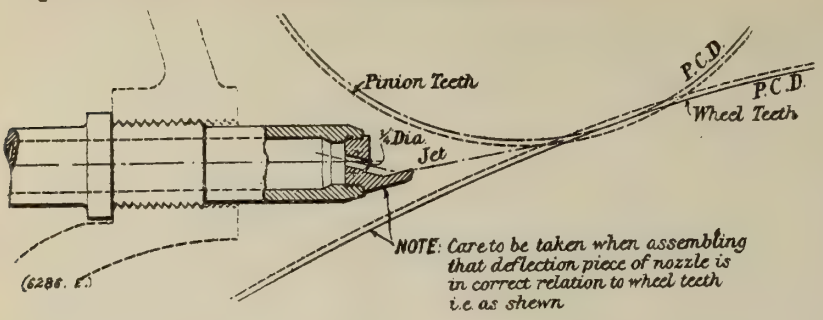


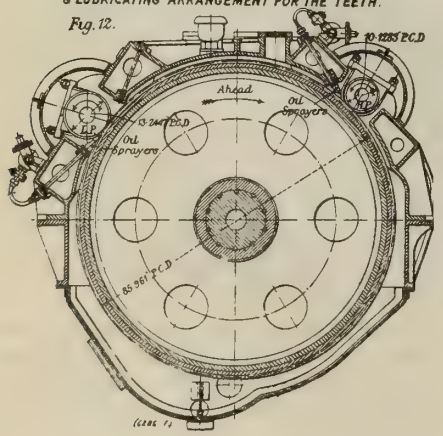
Fig. SPRAYER FOR LUBRICATING GEARING TEETH


Pinion Teeth
P.C.D.
P.C.D.
Wheel Teeth
⅛ Dia. Jet
NOTE: Care to be taken when assembling that deflection piece of nozzle is in correct relation to wheel teeth i.e. as shewn
(6288. E.)

free to remain parallel with the axis of the wheel, and the clearances in all the bearings should permit of this, otherwise misalignment will take place. Another cause that arises is that due to the deflection of the pinions and wheel, which in each case is of a double nature, viz., that due to the twist and that due to the bending. These points should not be overlooked in any design, but with the proportions brought about by other considerations, these deflections are not such as materially to affect the working of a correctly constructed gear. Apart from the above causes it has been observed in many gears that the load has not been distributed over the whole length of the teeth, an undesirable concentration of pressure having taken place on a portion of the length. This does not appear to be due to distortion under the twisting moment, as it has been observed at either of the ends of the pinion elements, and it has been attributed rather to an error in manufacture, the helical angle of the pinion element being slightly different from that of the gear wheel. It is necessary that particular attention should be paid to this important point right through the construction of gears, as many makers appear to be satisfied to assume that as this helical angle is a function of the machine mechanism, the angle will necessarily be correct, or at least within a microscopic difference. Unfortunately, in some cases, this has been found to be far from true, especially in the case of pinions, and it points to some torsional movement of the job during the cut. This may occur through strain of the driving mechanism when taking a heavy cut, or a slight slow slip

SECTION THROUGH A GEAR CASE FOR A TORPEDO BOAT DESTROYER SHOWING RELATIVE POSITIONS OF PINIONS & WHEEL & LUBRICATING ARRANGEMENT FOR THE TEETH.

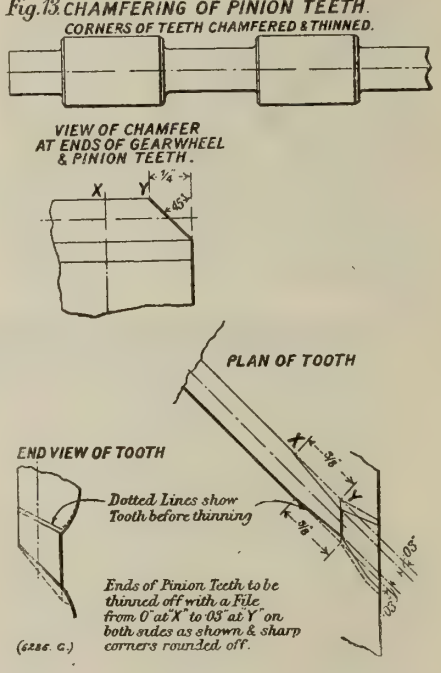
Fig. 12.



of the pinion in the chuck of the machine. It appears better that nothing should be left to chance, and that the angle should be tested after the gear is cut and before the work is removed from the machine, either by again running the hob through it so as just to touch the surface, or by a separate checking arrangement.

It is also to be noticed that even with an accurate helical angle of the components of a gear and correct alignment, perfect contact is not necessarily obtained, as owing to the hob receiving a certain feed for each revolution of the wheel or pinion being cut, the working face of the tooth is more in the nature

Fig. 13 CHAMFERING OF PINION TEETH.


CORNERS OF TEETH CHAMFERED & THINNED.
VIEW OF CHAMFER AT ENDS OF GEARWHEEL & PINION TEETH.
X
Y
¼"
45°
PLAN OF TOOTH
END VIEW OF TOOTH
Dotted Lines show Tooth before thinning
Ends of Pinion Teeth to be thinned off with a File from 0" at "X" to 03" at "Y" on both sides as shown & sharp corners rounded off.
(6286. C.)

of a number of facets than a fair curve. This is accentuated when the teeth are shaped in a single operation, as favoured by the majority of gear-cutters, and the faces are often observed to have a torn or scored appearance in the direction of the cut. It is a question, therefore, both from the point of view of correcting small errors in helical angle and the formation of fairer surfaces, whether a slight finishing cut should be taken and then the hob run through again in a different relative position to that in which the main cut was taken so as to remove the high points between the facets and to smooth the surfaces that have been torn, due to the hardness of the material when taking the primary cut.

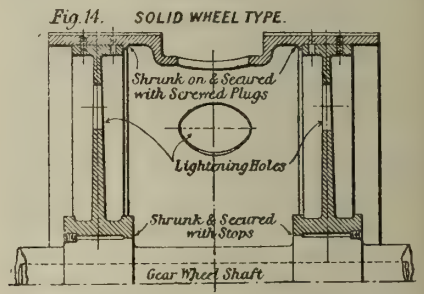
The speed of the teeth has an effect on the running and durability of the gear, owing to the intensity of shock on them. With the modern methods of cutting and manufacture, and with forged materials, the limits formerly used with spur gearing have been much exceeded, and there is ample experience to prove that satisfactory working can be obtained with speeds of 140 ft.-sec., and there seems no reason to assume that this speed could not be sensibly exceeded. The effect of the rise of temperature on the teeth, due to the rubbing contact when off the pitch line, has not appeared to be sufficient to affect the working in a well-lubricated gear. In general, a gearing ratio of 8 or 9 to 1 is not exceeded in naval practice of moderate and high power.

Typical gear ratios from naval practice are given in the table below.

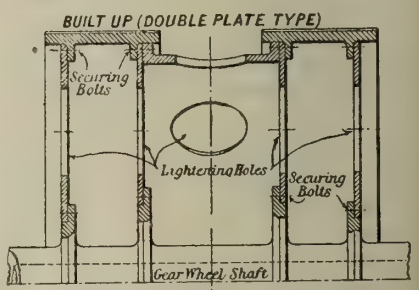
Type	S.H.P. per Pinion. H.P.	S.H.P. per Pinion. L.P.	Ratio of Turbine Revolution to Propeller Revolutions. H.P.	Ratio of Turbine Revolution to Propeller Revolutions. L.P.
Battle cruiser ..	17,500	18,500	7.1	5.2
Light cruiser ..	8,500	11,500	9.3	5.1
Flotilla leader .	9,000	11,000	8.3	5.0
Torpedo-boat destroyer ...	6,250	7,250	8.5	6.5
"K" boat	2,250	2,250	8.7	7.7
"P" boat	875	875	11.6	11.6

In the design of a reduction gear the question of relative axial movement between the pinion and the gear wheel is of importance. This movement takes place due to the necessity of the pinion requiring to adapt itself so that the load on each element should be the same. This movement is not difficult to cater for in a single reduction, as the gear wheel being fixed by the thrust

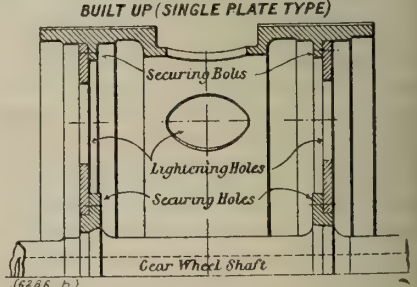
Fig. 14. SOLID WHEEL TYPE.

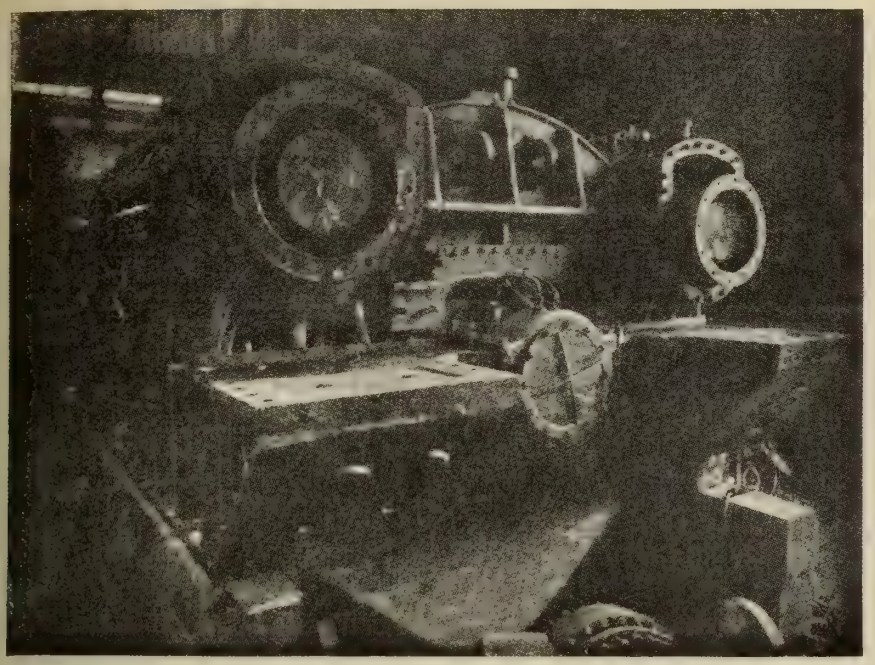


BUILT UP (DOUBLE PLATE TYPE)



BUILT UP (SINGLE PLATE TYPE)





GEARED TURBINES.

block, it is only necessary to provide an expansion coupling between pinion and turbine spindle, and allow clearance between the ends of the pinion elements and the adjacent bearings. The problem is, however, more difficult in the case of certain designs of double-reduction gear, as relative movement is required between the shaft gear wheel and the intermediate reduction element, and also between the latter and the pinion. The intermediate reduction wheel being a heavy fitting, for it carries four working faces, two of fairly large diameter and two small, possesses considerably more inertia than a pinion, and in the event of fitting such a gear in warships this aspect of the problem would require careful consideration.

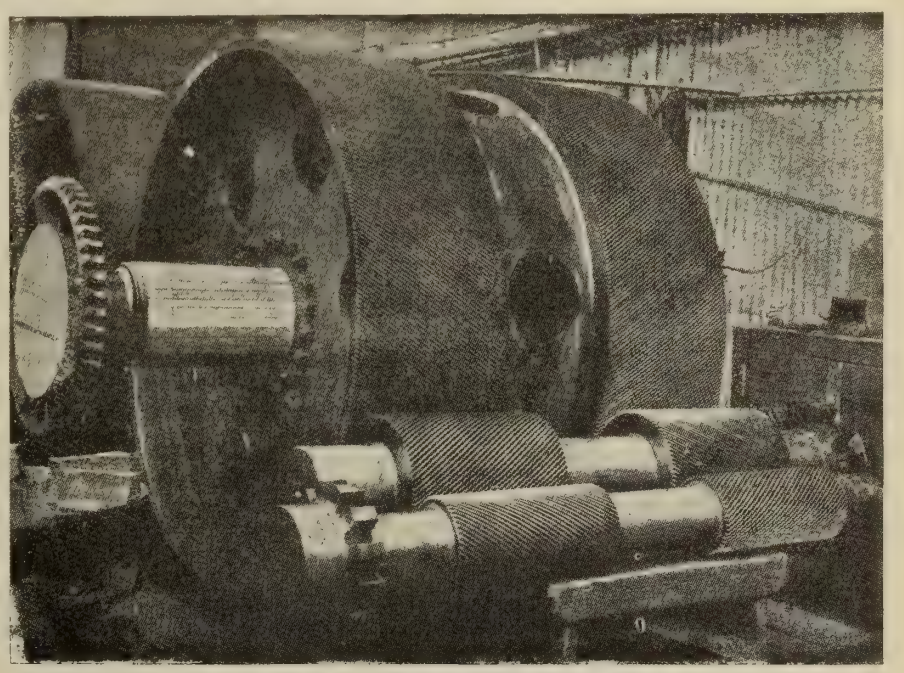
To avoid the same teeth of pinion and gear wheel coming in contact revolution after revolution, and also to ensure uniform wear, it is usual to fix the gearing ratio so that it is not only not a whole number, but the number of teeth in the wheel and pinion have no factor in common. This is seen in Table I.

In addition to the two cases of trouble with gearing previously referred to, there have been a few cases of failure due to the fracture of pinion teeth at their ends; this is the weakest part of the teeth, as no support is given on one side of the portion receiving the pressure. Chamfering off of the ends of the pinion teeth, as shown in Fig. 13 on this page prevents the load coming on the extremity. Fracture of these teeth might be expected with an error in the helical angle of the components, leading to an excessive intensity of pressure at one end of an element, but cases have occurred where a fracture has taken place, and yet an examination of the gears has shown the pressure to be uniformly distributed along the length of the tooth. Seeing that under these conditions the tooth stress is low, other reasons have been sought for these failures. Of the six cases, four occurred during the contractors' trials, one occurred after two and a half months, and the other after seven months' service. In neither of the latter two cases has the defective gear been removed from the vessel, and they are still running with the broken teeth having been trimmed off the gears dressed up. Defective material has been indicated as the probable cause of this defect, but although careful analysis has been made, in no cases have the results indicated anything seriously wrong with the metal, although it has been noted in one or two cases that the structure has not been the best possible. It should be noted that before the vessel has been accepted by the Admiralty the teeth of the high-pressure pinion in a destroyer have received their full load about 1,000,000 times, and in the case of a light cruiser about 600,000 times, and the causes of failure referred to may, in the absence of any other reasonable cause, be attributed to a fatigue at a flaw developed in the alloy during its manufacture.

The type of steel used for pinions must possess several essential qualities, viz., (a) strength to resist permanent deformation under stress; (b) stiffness, to avoid undue whip or elastic deformation when running; (c) surface hardness to prevent wear; (d) non-brittleness, so that it can stand shocks and blows. In addition, there is the important fact that the teeth have to be cut after tempering the material, as otherwise distortion of the teeth would arise. The specifications governing the materials for gear forgings for naval service and their treatment are given in the appendix.

It appears that finality in respect to the most suitable material for pinions has not been reached, and it is possible in future that the use of a chrome-nickel steel with a low percentage of chromium, say, from 0.3 per cent. to 0.5 per cent., will receive consideration for these details in place of the nickel steel now employed. It is known that the effect of very slight variations in the percentage of the constituents, variations that may occur in different parts of the forging under the best conditions, are sufficient to completely upset the anticipated results of the heat treatment, but judging generally from experience with service gears there does not seem any pressing reason to depart from present practice.

Before a vessel is accepted by the Admiralty the gears are opened up after the full power trials, and all surfaces and especially the roots and ends of



SET OF REDUCTION GEARS.

the teeth, scrupulously examined with a powerful magnifying glass to ascertain whether there are any flaws or signs of cracking present that may lead to subsequent fatigue failures.

During the early running of gears on service there is often observed on the faces of the teeth an action known as pitting. Small flakes of metal are detached from the otherwise smooth surface of the teeth, leaving small hollow depressions, varying in size from a small speck to as large as ⅛ in. diameter, and 15 thousandths to 30 thousandths of an inch deep. They are most common in the region of the pitch line, where only rolling action occurs. It is difficult to account entirely for this pitting. A lack of homogeneity in the material at the tooth surface (and careful analysis by micro-photography does reveal this), or crushing of minute high spots causing failure of small sections of the metal at these high spots are possible reasons for this pitting. This action in the vicinity of the pitch line may possibly be due to the metallic contact recurring there as a result of the failure of the oil film, observing that the rubbing velocity of the teeth is gradually reduced from a maximum at the tips and root to zero at the pitch line. In any case the action is not found to be deleterious to the smooth and efficient working, and it usually ceases after a short time. Deformation leading to scoring and wear of the teeth is a serious, but fortunately rare, fault in naval gears, and the only cases on service in which such wear has taken place were those previously referred to as having suffered from misalignment and in the case of a "P" boat referred to later. It has, however, taken place during the contractors' trials of at least two ships, involving removal with either re-cutting to a modified form of tooth, necessitated by the wear, or the substitution of another gear. The working is seriously prejudiced by such wear, as, apart from the reduction of life involved, it is accompanied by excessive noise and heavy "shivering" of the gear, which transmits its effects to the turbines and subsidiary fittings, causing failure of lubricating pipes, etc. Once deformation is present, or sets in, the whole face of the tooth is affected, even at the pitch line, where the contact is more of a rolling nature, as, due to the wear of the faces of the teeth, there is a tendency for the points of the harder pinion teeth to "dig in" and tear across the flank of the tooth when disengaging, the concentration of the load on the pitch-line then being so great as to cause elastic deformation and a continuation of the digging in, failure of the oil film takes place, and the whole surface of the tooth is scraped away. In the two cases referred to, during trials some slight error in the toothform was considered to have been the cause in initiating the action, being then accentuated by the consequent failure of the oil film.

From this same point of view any grinding in of the gears, apart from the practical difficulties of carrying it out, appears to be undesirable on theoretical grounds, and as it causes wear of the flanks and faces of the teeth, it leads to an undue concentration of pressure on the pitch-line. A few service gears have been subjected to this operation, but it is not now being applied.

Another usual feature in gears during their early life is for a minor action of the above nature to take place, the teeth at the regions of higher pressure being rubbed away, or caused to flow so that a sharp razorlike edge or small "rag" is formed on the points of the teeth. It can be stated as a general principle, however, that once these harder regions of pressure have been "beaten down," the load is more uniformly distributed, and the action does not continue, nor is the working of the gear affected.

With the oils used for naval service corrosion of the gears does not take place. Some slight admixture of water with the oil always takes place, chiefly due to steam from the turbine glands entering the adjacent bearings, but beyond a rusting effect of the wheels and pinions generally the working faces are not affected. It has been suggested that in the early life of a gear it might be advisable to use an oil carrying a proportion of graphite, from the point of view that under the working pressure the microscopic irregularities in the surfaces would be filled by small particles, and in a short time highly polished surfaces obtained. As the lubricating system of gearing is, however, common with that of the turbine installation, it has not been generally adopted, but recently this is being tried in two torepodo-boat destroyers.

From the general experience so far gained there is no reason to suppose that gearing should not have a long life, provided that a reasonable amount of care be exercised in running an installation that has successfully passed through its specified trials. Gauges are supplied for testing the wear of the teeth, but as in practically all cases the wear is inconsiderable, it is not usual to keep records of this.

Some cases of failure having been mentioned, it is of interest to sum up as a whole and see how far the anticipation of reliability has been substantiated. Of the 596 sets of all-geared installations on service in the navy, some extending up to nearly six years, it has only been necessary to actually remove three for refit in the misalignment cases referred to, and here it must be emphasized that no actual breakdown occurred, and the gears, after dressing up and in one case new pinions being supplied, were subsequently re-utilized. Also in the case of one of the "P" boats the two gears had to be removed on service owing to their becoming noisy and wearing slightly. The wheels were "dressed up" and new pinions fitted. Of the cases of fractured teeth, which are two in number, the gears were not removed, the broken or cracked portions being removed and damaged teeth smoothed up. In another case a breakdown occurred through a ⅞-inch bolt, inadvertently left in the gear-case, passing between pinion and wheel and damaging a portion of the length. This set was replaced by a spare, but the old wheel after cleaning up is retained as a spare with 3 inches of the tooth face out of 40 inches total missing. The failures on trials have been four with fractured teeth and two with excessive wear, and it must be admitted that these figures are most satisfactory when it is remembered that the development and experience of these gears for high powers was, except for a few cases, confined to warships.

Apart from the reduction in size of the turbines which led to more rigid and reliable units, there is a great decrease in the quantity of turbine blading required, and at one period of the war, owing to the enormous demands for copper in the munitions, etc., service generally, any question which lessened the demand for the supply of this metal or its alloys was of importance, and the reduction in blading required owing to the adoption of the all-geared installations reduced the strain on the blading makers, and avoided any possible delay in the construction of warships from this cause.

Some typical figures showing this are: In a direct-driven torpedo-boat destroyer of 25,000 shaft horsepower, the total length of blading sections fitted is approximately 70,000 ft., as compared with 7,720 ft., in an all-geared installation of 27,000 shaft horse-power. As, however, the section of the blading in the all-geared type is heavier, the weight is not in the same proportion, being as 4 to 8½ tons. Apart from the saving of fuel, and slight reduction in boilers owing to the gain in economy, there is no great saving of overall weight in the all-geared installation, the gearing being a heavy fitting and helping to outweigh any saving obtained on turbines and boilers. Some typical weights are:

		S.H.P.	Total w'ght tons	S.H.P. per ton
Torpedo-boat destroyer	Direct driven	25,000	372	67.5
	All-geared..	27,000	393	69.0
Flotilla leader..	Direct driven	36,000	554	65.0
	All-geared..	40,000	615	65.0

The question of economy which was one of the primary reasons for fitting reduction gearings has been substantiated. Generaliy speaking the advantages of the present all-geared installations over the most recent direct-drive types fitted are shown in the table below, the figures being based on the increase of the radius of action for the same quantity of fuel under service conditions, and therefore taking into account the gain in economy in the turbines and the effect of an increase in propulsive efficiency.

Percentage Increase in Efficiency of Geared Installations

	One-fifth Power	Two-fifths to Three-fifths Power	Full Power
Light cruisers	16.5	16.3	16.1
			At 30 knots
Flotilla leaders	20.0	20.0	17.0
Torpedo-boat destroyers	20.0	20.0	20.0

The initial steam conditions in the cases of the all-geared and direct-drive installations are the same in each case.

It should also be noted in this particular that superheated steam has not up to the present been used in any all-geared turbine installation in the naval service, but with the advantages to be gained from the possible adoption in the future the smaller rigid turbines used would conceivably be more adapted for superheat than the larger direct-drive units.

The author is indebted to Messrs. Thornycroft for the photographs of the gearing of a torpedo-boat destroyer and a flotilla leader, illustrating this paper.

Appendix.

I.—Extract from Admiralty Specifications

Gearing for Turbines.—The bearings, shafting, and all parts of the gearing in connection with the turbines are to be accurately in line and the pinion shaft is to be truly parallel with the shaft of the main wheel, and the gearing is to be most accurately adjusted for correct working. The whole of the above parts will be tested both in the shop and when erected on board to ensure that these conditions are observed. The supports of the gearing are to be rigid, and the whole system is to be worked without vibration on trials.

When the pinion bearings are bored and fitted in place to give correct oil clearances a circle concentric with the bore is to be clearly marked on the ends of the brasses for guidance in boring after subsequent remetalling.

The gear wheels are to be of forged steel and the rims upon which the teeth are cut are to be separate from the body of the wheels.

Special consideration is to be given in the design and method of construction of the pinion and gear wheels to ensure that the process of manufacture of the parts upon which the teeth are cut is such as to ensure maximum uniformity of material and as equal a degree of hardness as possible over the whole of the working surface of the teeth. This condition is to be demonstrated if required to the satisfaction of the Admiralty Inspecting officers.

The teeth of the gear wheels and pinions are to be chamfered at the ends in accordance with latest practice.

	Ultimate Tensile Strength.			
	Not more than, Tons, per Sq. In.	Not less than, Tons per Sq. In.	Elongation in 2 in. Test-Piece "D" or "E," as Approved. Not less than, per cent.	Bending Test, Angle not less than
				Deg.
Rims of gear wheels	35	31	26	180
Gear-wheel shafts ..	38	34	23	180
Main gearing pinions:				
In the direction of axis of pinion ..	..	40	23	180
Across the axis of pinion	45	40	16 (On C test-piece)	180

The gearing is to be cut by approved makers and in machines of approved type, and the accuracy of these machines is to be demonstrated, if required, to the satisfaction of Admiralty inspecting officers. The lubricating arrangements for the gearing and pinion shaft bearings are to be carefully considered and specially submitted for Admiralty approval.

The teeth of the gear wheels and pinions are to be cut with a spiral angle of 30 degrees at the works of the same maker.

The flexible couplings are to be made independent of rotor spindles and pinion shafts and fitted with provision for lubrication on an approved principle.

The pinion element of the gearing is to be of nickel steel containing about, but not less than, 3.5 per cent. nickel and 0.3 per cent. to 0.35 per cent. of carbon.

The pinion gearing may be formed in separate rims shrunk on to the shaft and suitably secured in an approved manner, or manufactured solid with the pinion shafts. If made in separate rims the blank is to be hollow forged or rolled, leaving as little margin as practicable for turning off on the internal or external diameter, but at least 1 in. is to be machined off each end of the blank after forging.

If made solid with the shaft, the pinion blank is to be reduced at least 2 in. in diameter and 2 in. on each side of each pinion blank by machining from the finished forging. The pinion shaft is to be hollow, and after rough machining it is to be oil-hardened by the following or other approved process:

The forging is to be heated to 850 deg. C. and then quenched in oil, this to be followed by tempering at 600 deg. C.:

In both treatments the time of heating is to be the minimum required to raise the centre of the forging to the specified temperature, and this minimum should not be exceeded by more than half an hour.

The gearing teeth are to be accurately shaped, are to be well rounded off at the roots, and are to have approved clearances in the pitch circles.

Test Pieces.—Test pieces are to be taken from each forging, and may be cut off after annealing.

Tensile Tests.—The test pieces are to satisfy the conditions of the preceding table.

II. Gear Wheels

The gear wheel is made up of a continuous shaft, of the rim, and of a centre uniting the shaft to the rim. The centre may be made of a solid steel casting, or of two or more forged steel wheels or be constructed of plates.

Fig. 14, page 146, shows sections through typical wheels. Cast and forged steel wheels are shrunk and pinned to the shaft, and the rim is in turn shrunk and pinned onto them. Plate centres are bolted by fitted bolts to flnages, made solid with the shaft and with the wheel rim respectively. The larger designs are arranged with a separate casting keyed to the shaft which carries the flnages of the centre plates. The rim is made of forged carbon steel of tensile strength. 31 tons to 35 tons per square inch. The two portions of the rim in which the teeth are cut are made in one piece for those designs in which the rims are shrunk on to the wheel centres comprised of steel forgings or castings. In the build-up designs of wheel centres comprising plates, each rim section and the intermediate portion of the rim joining them is made separately and bolted together. This is necessary for constructional reasons except in every small designs.

No special advantages as regards working on service are claimed for either form of construction, and no cases of failures of wheels or gear cases structurally have occurred on trials or service.

Fig. 13, page 146, shows the method of chambering off the corners of the teeth of the pinions and gear wheels to prevent any possible excessive stress being taken on an overhung or incompetey supported extremity. As a further safeguard to the teeth of the pinions having in view the effect of deflection they are also thinned off as shown. This thinning off also keeps the load off the end of the wheel teeth.

In a recently issued Bulletin of the United States Geological Survey some information was given on the subject deep wells and shafts. This Bulletin, according to the South African Mining and Engineering Journal, is incorrect in regard to the depth of shafts. It says that the deepest mine in the world is shaft No. 3 of the Tamarack Mine in Houghton County, Michigan, which has reached a depth of 5200 ft. The Bulletin, it is presumed, refers to metalliferous mines only. If this be so, then the deepest mine in the world is the Turf shaft of the Village Deep, Limited. The vertical portion of this shaft intersects the reef at 4300 ft. and on the continuation of the blanket beds the incline has been sunk an additional 3000 ft. The vertical depth from the surface to the bottom of the incline is now 5861 ft., so that the Village Deep Turf shaft is more than 600 ft. deeper than the No. 3 of the Tamarack Mine. The Turf shaft is now, in fact, down to sea level.

Experience has shown that wire ropes of compound construction, subjected to corroding influences, are likely to deceive engineers as to the strength remaining in them, says a circular issued to managers of mines on the Rand, South Africa. Where reduction of diameter or circumference of the rope has taken place, not accounted for by the evidence of wear, the part of the rope under examination should first be fully loaded and then relieved of the load. Any noticeable difference in circumference in these circumstances and slackeneing of the outside wires when the load is off will indicate that internal corrosion has taken place. The extent of corrosion inside the strand can only be estimated by the slackness of the outside wires. The corrosion between the strands can be further examined by untwisting the rope or displaying the strands sufficiently with a marlin spike.

Comparison of Two and Four Cycle Diesel Engine

The Choice Between These Types of Internal Combustion Engines is Discussed in a Paper Read Before the Grimsby Institue of Engineers and Shipbuilders.

By P. S. EVERETT, A.M., I.C.E.

THE first large Diesel engines installed in ocean-going boats were the four-cycle type by Burmeister and Wain, and they were immediately successful. Then came a hot controversy on the relative merits of the two and four-cycle design, and a considerable number of two-cycle engines were built and installed, and the majority were not successful. However, there were many important marine engineers both in this country and abroad, who, despite all failures, considered that the two-cycle system was the one most suitable for marine work and would ultimately prevail. It must be remembered that the builders of the successful four-cycle design had long been successful builders of the same type engines for land service, and the marine design was only an adaptation of their land experience. On the other hand, very few firms in those early days had much experience with the two-cycle design, and it is to be regretted that many motor ships fitted with two-cycle engines were rushed into service, the engines of which had not been thoroughly tried out on the test-bed. The position is very different now, and despite the lee-way which had to be made up, and five years of war, there are several designs which have passed through very severe trials on the test-bed, and are ready for installation on board. It is worth remarking that one firm—Messrs. Sulzers, who have probably built more Diesel engines than any other firm in the world, including large numbers of both four-cycle and two-cycle engines, have adopted the two-cycle as their standard for marine work. The portion of the Diesel engine on which reliability depends is the combustion chamber and its surroundings, including the valves. During the working of the engine the combustion chamber has to withstand temperatures of 3,000 degrees Fahr., and pressures of 500 lb. per sq. in.; obviously the cylinder head, cylinder liner and piston which form the bounding surfaces are subject to very severe conditions. The piston and cylinder liner being circular and of even thickness give comparatively little trouble, but serious trouble is possible with the cylinder head in the case of the four-cycle and valve scavenging two-cycle engines for well known reasons, and, on account of the total elimination of cylinder head troubles, the two-cycle port-scavenge engine is much to be preferred. It must not be forgotten that for the same size cylinder the two-cycle engine, while generating much more power, also generates twice the amount of heat, but the cover is of such simple design for a port-scavenge engine that it is quite safe. An opposed-piston two-cycle engine avoids the use of covers altogether, but it introduces other features which may not be considered good practice in a marine engine. The exhaust valve is also subjected to this intense heat, and whilst none is fitted in a port-scavenge engine, it is an essential feature of every four-cycle engine, and is a weak spot for various reasons. To ensure these valves keeping in good working order, the mean pressure in the cylinder must be kept low for continuous running, say, 83 to 88 lb. per sq. in., as it is essential that there be no excessive temperatures and no after burning. If this figure is exceeded for continuous running or large engines, then failure is very rapid in the case of both the exhaust valve and the cylinder head. On the other hand there are quite a number of port-scavenge engines which have run, even on bad fuel, for several years at a M.E.P. of 100 lb. per sq. in. without a single breakdown, and are capable of taking a considerable overload in an emergency for a short time.

Reliability follows in the train of simplicity, and a four-cylinder two-cycle engine has more even turning moment and is more easy to start and manoeuvre than a four-cycle engine with six cylinders. It is unnecesary to draw a detailed comparison of the number of parts, as it is perfectly obvious that four cylinders of a simple port scavenging engine, even allowing for the scavenge pump, is a far simpler machine than six cylinders of a four-cycle engine with its many valves, cams, rollers, tappets, levers, etc.

Economy in Operation.

The principal items effecting this are:—(1) Consumption of fuel. (2) Price paid for the fuel, and (3) lubrication. As regards fuel consumption, a distinction must be drawn between high-speed small engines, such as electric generating sets, which run on a good class fuel, at an easy rating, and the heavy slow-speed marine engine, which must for financial reasons run as near as possible to its most efficient load, and on any fuel which may come along. It is readily admitted that for high-speed small power engines, such as are used for electrical generating sets, the four-cycle engine when properly adjusted for a good class fuel can show the very lowest fuel consumption and are very reliable. The engine of this type built by Messrs. Mirrilees, Bickerton and Day, Stockport, is an excellent example which is probably not excelled by any maker in the world.

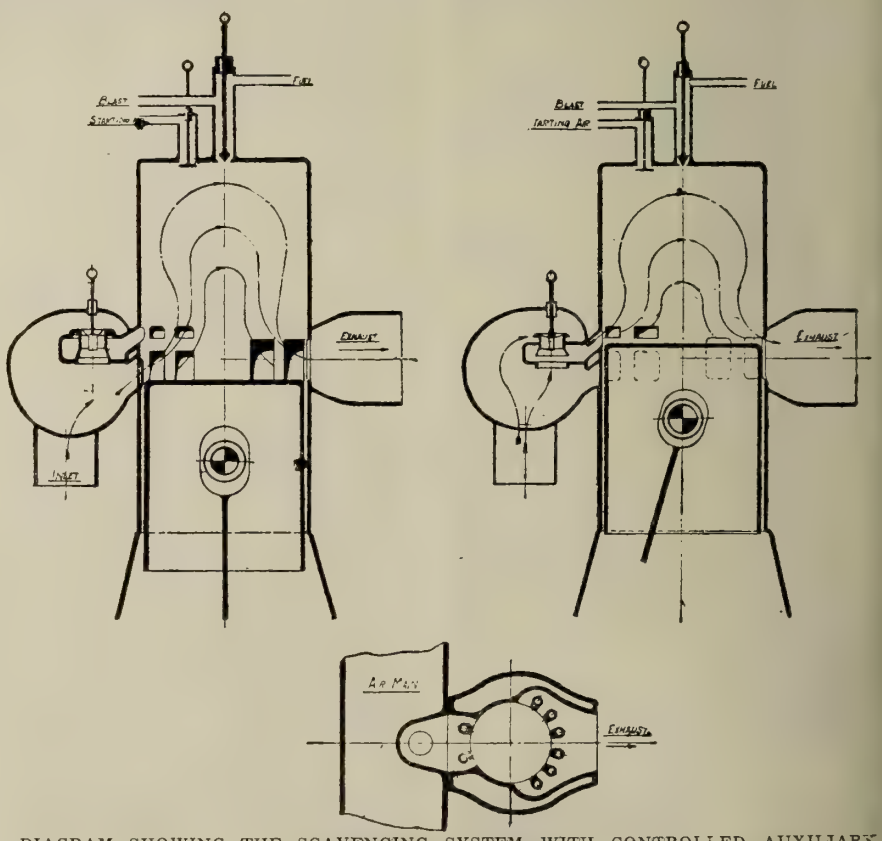


DIAGRAM SHOWING THE SCAVENGING SYSTEM WITH CONTROLLED AUXILIARY SCAVENGING PARTS.

It is also a fact that the Germans took most of their two-cycle engines out of their submarines and installed four-stroke engines, but here again it was the high-speed type engine, and in addition it was a case of comparing a four-cycle engine of the highest order with a two-cycle engine of unsuitable design.

The case of the merchant marine engine will now be examined.

Consider first a six-cylinder four-cycle engine running on full load with all its necessary accessories, air compressor, circulating water pumps and piston-cooling pumps. The consumption under the most favourable test-bed conditions would be 408 lb. per b.h.p. hour, a figure which is confirmed by published data, but as already stated, on service, the M.E.P. is reduced by about 10 to 15 per cent. in order to lengthen the life of the cylinder head and exhaust valve, and this means an increase in fuel consumption of from 3 to 4 per cent. as definitely proved by experiments, thus bringing the service consumption, which is what counts, up to .42 lb. per b.h.p. hour. In the case of a corresponding two-cycle engine of the Sulzer controlled-port scavenging type—which would operate at full load, the consumption would be .418 lb. per b.h.p. hour, which would also include all pumps and scavenging air pumps.

Before comparing a consumption stated per i.h.p. with one stated per b.h.p. it is very necessary to know what load was on the engine so that the mechanical efficiency can be correctly estimated.

Based on service conditions at sea, there is nothing to choose as regards the weight of fuel consumed between the best four-cycle engine and the right type of two-cycle engine; but to a shipowner fuel consumption is only another name for £.s.d., therefore for a full comparison under this heading, the price paid for the fuel must be considered. Now it is a well-known fact that the four-cycle engine cannot burn fuels which contain even only a moderate percentage of asphalt on account of the exhaust valve, for even if the fuel valve is adjusted, which is the work of a skilled Diesel engineer, failure is only delayed for a relatively short time.

In fact all four-cycle boats at the present time must fuel on a good class oil known as "Diesel engine oil," which must be quite free from asphalt.

Now the cheapest fuel oils at the present time are Mexican and Californian, both of which are high in asphalt and sulphur, and it is worth remembering that these countries will probably be the chief future suppliers of the world's markets. It is here submitted that the Diesel engine ship can never efficiently compete with the steam boiler ship till it can burn in its cylinders any oil which can be burnt under the boiler and with no more adjustment of gear. A trading tramp must be free to bunker at any port and to burn any fuel which may happen to be the cheapest on the market.

The controlled-port scavenging two-cycle engine can successfully burn without adjustment of gear Mexican and Californian crude oils containing as much as 15 per cent. asphalt, so when the price of the fuel is reckoned along with the lbs. per b.h.p. it is obvious that for marine propulsion the four-cycle is not as good as the right design of two-cycle engine.

As regards lubricating oil consumption, much has been made of the reported large consumption of some two-cycle boats, but this too obviously depends on the engineers on watch, and the condition of the engine, that too much importance should not be placed on these reports. Owing to the heat, the piston is responsible for a large proportion of the consumption, and a two-cycle piston owing to receiving twice the number of impulse strokes must get hotter than a four-cycle, but for the same horse-power it is much smaller, and so has less rubbing surface, and further the efficiency of the piston-cooling system must be taken into account. In the case of the four-cycle engine, the hot exhaust valve spindles of which there is one per cylinder, accounts for the evaporation of a large amount of oil. Further the number of bearings to be hand-oiled about the valve gear of a four-cycle boat totals up to a most surprising number, about 400 for an average twin-screw boat. There is a difficulty in connection with the two-cycle engine, which does not occur in the four-cycle, i.e., in a two-cycle there is no reversal of load on the bearings which makes it most advisable to fit an efficient forced lubrication system. However, all Diesel engines should be fitted with forced lubrication, so when all points are considered there is not much to choose on the score of economy.

Weight and Space Occupied.

It is here that a well-designed controlled port scavenge two-cycle engine takes the lead over the four-cycle engine as regards marine work. As already pointed out, the four-cycle only develops about 85 lbs. per square inch M.E.P. on voyage conditions, and it is generaly considered good enough if 95 to 100 lbs. per square inch is obtained on short trial runs. Ample data have been published in the technical press to substantiate this. For instance, one motor ship on trial trip recorded 11.75 knots with a horse-power corresponding to a M.E.P. of 97 lbs. per square inch. Now, the contract speed was 11 knots, so it follows that the M.E.P. would only be about 85 lbs. per square inch for normal conditions.

The cylinder of a Diesel engine is like the furnace of a boiler, in that the power generated depends on the weight of fuel which can be burnt, which, in turn, depends on the weight of air present to support combustion. In a four-cycle engine, since the air is drawn in, the weight present cannot exceed a cylinder full at atmospheric pressure, although this cycle gives the best scavenging effect. In a two-cycle engine with ordinary port scavenge, the exhaust ports are always open after the inlet ports have been covered by the piston, therefore the air present can never exceed the volume at the point of covering the exhaust ports. A valve scavenge engine shows up very favourably here, as the valves in the head can be kept open after the exhaust ports have been covered, and the amount of air taken into the cylinder increased, but this type of engine has been utterly condemned, due to the cylinder head. The simplicity of the port scavenge is combined with the advantages of the valve scavenge in the case of the Sulzer patent valve controlled port scavenge engine, shown in the illustration. For this design gives time for the pressure in the cylinder to fall before the scavenge port opens, giving an opportunity for good scavenging, and, further, permits the efficient filling up and supercharging, if required, of the cylinder after the exhaust ports have been closed. This permits a large M.E.P. to be carried, say 100 lbs. per square inch on voyage, with a capacity for a considerable overload. Now, a two-cycle engine has two working strokes for one of the four-cycle engine, so for the same number and size of cylinders, the two-cycle engine gives more than twice the horse-power of the four-cycle engine. In an endeavour to discount this difference, the four-cycle marine engine is usually run about 10 per cent. higher r.p.m., but, of course, some, and probably most, of this extra horse-power will be lost in the less efficient propeller, as well as shortening the life of the engine. Now, the maximum pressure in the cylinder on which the designed load for the scantlings are based is the same in both cases, so this difference in the M.E.P. carried and number of cylinders is reflected in the weight and space occupied, much to the advantage of the two-cycle type.

First Cost.

In the case of any particular design of engine, both space occupied and weight can be reduced by working to high pressures and high speeds, and the engine is thereby cheapened, but, of course, the life of the engine is reduced. It is quite a different case with the reduction in space and weight of the two-cycle engine, as compared with a four-cycle, for here the reduction is in virtue of the principle involved, and so the engine, while being cheapened, has not been robbed of any good qualities. Of course, the two-cycle engine must be cheaper to manufacture, even after allowing for the new features of design which are introduced.

Conclusion.

There has not been time to examine all the special designs mentioned under heading of "Type of Engine," but, after making full allowance for the fact that at this stage of development it is most essential to keep an open mind on the subject, it is considered that for marine propulsion:—

(1) It is advisable to keep to the pure Diesel cycle as already defined, which includes air injection of the fuel, for the following reasons:—

(a) The high thermal efficiency giving better economy on voyage conditions.

(b) Ability to burn a large variety of different fuel oils.

(c) Better control under variable load running.

(2) It is advisable to retain the inverted vertical type of engine, with single cylinders in a row with air compressors and pumps in line, as this general design has proved itself, over a long number of years, to be so suitable, reliable, and accessible, and, further, offers the best avenue for developing into a double-acting engine when the limit in cylinder diameter is reached, and still greater horse-powers are called for.

(3) That the two-cycle valve-controlled port scavenging engine offers the best solution for:—

(a) Present horse-powers on the score of reliability, economy, and saving in weight and space for the reasons mentioned in this paper.

(b) When fitted with an independently-driven turbo-pump for the supply of scavenge air, it gives the highest horse-power that can be obtained from a given cylinder diameter.

(c) That it permits supercharging which is considered to be the most hopeful way of obtaining a substantial reduction in the weight of machinery per horse-power.

The Motor-Engined Oil Tanker "Narragansett"

THE Anglo American Oil Company's steamer "Narragansett," built by Vickers, Limited, of Barrow in Furness, and engined with their solid injection type of oil engine, ran her trial trips recently off the mouth of the Mersey. The vessel is an interesting type, being built on the Isherwood system, an oil tanker, and propelled by internal combustion engines. She is of 10,500 tons deadweight, her dimensions being 425 feet b.p.; breadth, 56 feet 8 inches; depth moulded to upper deck, 33 feet. The engines are placed right aft, as the custom is in this type of vessel, and the accommodation for the engineers is contained on the poop. Her cargo carrying capacity is 9,450 tons of oil of .9 specific gravity, and her fuel tanks can hold 750 tons of oil. These tanks are placed fore and aft, and can be utilized for trimming purposes. The main oil tanks are ten in number, centrally divided by a bulk head, and the hatches are carried through trunks to the upper deck. Their total capacity is 432,000 cubic feet. The Summer tanks in the wings have a capacity of 52,000 cubic feet.

The speed attained on the trial trip over a run of eight miles was 11.2 knots on a draught of 26 ft. 3 in. The consumption of oil at this speed would give a daily consumption of 11 tons.

There are two sets of engines driving twin screws, each set consisting of six cylinders, the diameters being 24½ in. and the stroke 39 inches. The engines develop 1,250 b.h.p. at 118 revolutions per minute, making a total b.h.p. of 2,500. The cylinders of each engine are arranged in two groups of three each, and the crank shafts are built up of two solid forged three throw pieces coupled together. The cranks are set at 120 degrees, and the arrangement of firing is 1, 5, 3, 6, 2, 4, from forward to aft.

The cam shaft gearing is placed in between the two groups of cylinders on each engine, the cam shaft being driven off the crank shaft by spur and skew gear. The cam shaft operates the valves, of which there are three in each cylinder head, an air suction valve, exhaust valve, and oil inlet valve. The air inlet pipes are closed at the top, and perforated with narrow slots to allow the entrance of air. Gear is provided, operated from the starting platform, to cut out any fuel injection valve desired, and also to alter the timing and period of injection, thus varying the power at will. The oil is injected by means of a four-throw pump, driven by gearing from cam shaft, and delivering the oil to the fuel injection valves at about 4,000 lbs. pressure, which allows it to enter the combustion space at about 400 to 500 lbs. pressure, according to the power being developed by the engine at the time.

For manoeuvering purposes a vertical steam-driven air compressor has been fitted, which delivers air at a pressure of 600 lbs. per square inch to a bank of ten bottles placed at the after end of the engine room. Compressed air is, of course, not required for the fuel injection.

The cams are mounted on the cam shaft in pairs, for ahead and astern motions. The shaft carrying the fulcrum levers runs directly above the cam shaft, and the fulcrum levers are mounted eccentrically on this shaft, so that by rotating the shaft the levers can be lifted clear of the cams. Reversing is effected by a compressed motor, which rotates the lever shaft sufficiently to raise the levers from the cams, when a further movement of the reversing lever slides the cam shaft in a fore and aft direction, bringing the astern cams under the levers. A further rotation of the lever shaft then brings the levers in contact with the cams again. For starting the first movement of the starting wheel opens compressed air to all the cylinders, after which air is cut off and oil delivered to the cylinders in pairs until all are receiving oil. The average time consumed to reverse from ahead to astern was, on the trial trips, 10 seconds, and from stop to astern, 8 seconds. The pistons are water cooled, fitted with telescopic pipes for this purpose, and have cast iron rings. The piston rods are fastened to large crossheads, which have shoes bearing on guide plates bolted to the cylinder columns, while the connecting rods are of the usual marine type, the top and bottom and brasses being of cast steel, with white metal lining. The main bearings are of cast iron, with white metal lining. The cylinders, cylinder heads, and cylinder loners are of cast iron, and in addition to the three valves already mentioned each cylinder is provided with a relief valve. The construction of the engine framing is very rigid. There are eight hollow H-shaped cast iron columns, of box section, connected at the top by cast iron distance pieces. Through the centre of each column tie rods are led, for the purpose of taking up the impulse reaction. There are sixteen of these tie rods, of heavy section. Light cast iron trays are placed between the columns and above the crossheads, and these are fitted with oil wiper glands, which protect the lower parts of the engine from any oil or moisture dropping from the pistons. The thrust is taken by a Michel thrust block. For turning a rack is provided on the fly wheel. The forced lubrication is provided for by vertical plunger pumps, driven off the main engines, and an independent steam-driven pump is also provided for this purpose. Each set of engines is provided with a horizontal oil cooler. There is a three-furnace Scotch type marine boiler, situated on a stringer above the main engine forward, and one vertical Annan boiler in a stokehold forward of the engine room. These boilers are oil fired, and there is a complete auxiliary condensing set provided. There is a direct connected engine generator set, the engine being a steam unit, and a second set is driven by a Vickers Petter oil engine. There are steam-driven ballast, fire and bilge pumps. Two electrically-driven Drysdales centrifugal pumps for stand-by cooling service water when in port, and a steam-driven CO^2 refrigerating plant built by the Pulsometer Engineering Co. For pumping the cargo two pumps each of 200 tons capacity, are placed on the upper deck amidships, and are arranged to pump from any tank to any other one or overboard. The stearing gear is of the Hydro-Electric type, built by William James. The vertical boiler is of sufficient capacity to supply all the auxiliaries while at sea, and the Scotch boiler is reserved for steaming out the oil tanks.

The vessel is a very fine example of modern practice in oil tank steamer construction.

Particulars were recently given in the Bulletin of the Federation of British Industries of Finland's potential water power resources. Out of a total estimated water power of 3,000,000 horse-power at average water level it is considered that about 1,050,000 horse-power could be of direct use for industry. Of this only 150,000 horse-power is at present utilised, thus leaving considerable possibilities of development. Of the 79 waterfalls in Finland with potential capacities of horse-powers from 5000 to 300,000, 42 range from 5000 to 20,000 horse-power, 25 from 20,000 to 50,000 horse-power, 6 from 50,000 to 100,000 horse-power, and 6 from 100,000 horse-power to 300,000 horse-power.

How Many Sizes of Shafting Should We Have?

IN ANSWER to the above query, the American Society of Mechanical Engineers recommend that fourteen sizes of transmission shafting be used. The committee of this society devoted to War Industries Readjustment, state that an immense amount of steel is continuously tied up in manufacturers' and dealers' stocks of shafting and that a corresponding amount of cast iron is also held in stock in the form of hangers, bearings, couplings, collars, bushings, pulleys, etc. At the suggestion of the chairman of the committee on War Industries Readjustment, a committee was formed to investigate the subject of the standardization of shafting sizes. The personnel of the committee is as follows: Cloyd M. Chapman, chairman; George N. Van Derhoef, Hunter Morrison, Louis W. Williams, and Russell E. Nelles.

This committee was confronted with two distinct but closely related problems, namely, standardization of the diameters of shafting used for transmission of power, such as lineshafts, countershafts, etc., and the standardization of the diameters of shafting used by machinery manufacturers in making up their product. The first of these problems seemed to be the simpler of the two. While a large number of sizes of transmission shafting are now listed and stocked, it was believed that comparatively few of these are in extensive general use. Accordingly, a letter was sent to thirty-six of the largest manufacturers and dealers in transmission shafting asking for statistics on the consumption of each size of shafting handled by them. About twenty of the largest concerns in the industry furnished complete statements of their sales over periods of time chosen by themselves. These data were reduced by the committee to a uniform basis of percentages. The amount of each size sold was expressed as a percentage of the total sales, both on a weight basis and on a lineal-foot basis. From these data, plotted in the form of a diagram, it was evident which of the sizes were popular and generally used and which were more rarely called for. A tentative list of twelve sizes was prepared from this diagram and sent to forty-six other dealers in transmission shafting and shafting supplies, from whom twenty replies were received.

In the letters to these firms, the committee expressed the opinion that the custom of using shafting 1/16 inch under the unit sizes is so firmly and so nearly universally established in this country, that it would be unwise to attempt to adopt sizes in even inches and fractions as standard. It was pointed out, also, that certain sizes stand out pre-eminently as "popular sizes" and that others are sold in relatively small quantities. It therefore seemed feasible to reduce the number of sizes now listed by the trade from fifty or sixty down to twelve or fifteen.

The response to these letters was practically unanimous in opinion. The transmission shafting users and dealers approved the plan of standardization, and the sizes suggested were generally approved except that the diameters 1 11/16 inches and 2 3/16 inches were in many cases requested to be included. After due consideration the committee decided to include these two sizes in the original list, making the fourteen sizes now adopted as standard.

Shafting Sizes Used in Machine Design

The second problem was a more intricate one. The number of sizes now produced by the rolling mills for use in machinery is very large. Almost every sixty-fourth of every inch up to three inches is drawn. If a reasonable number of these sizes could be eliminated or classed as "specials" and a comparatively few sizes selected as standard or stock sizes, a great saving would be effected. In order to get the opinion of leading consumers of shafting for machinery purposes, the committee decided to lay the plan before 225 large consumers of this material. It was explained that it was not intended that the adoption of certain sizes as standard should make it impossible to secure any other size required on special order.

In the case of machinery shafting the users were equally unanimous in their approval of the plan to standardize sizes, but recommendations as to size intervals varied greatly. However, these recommendations, in so far as they were definite and specific enough, were tabulated and a diagram constructed showing the relative popularity of the various size increments for each inch of diameter.

With these data accumulated and sifted down to usable form, the committee felt that it was in a position to present its information and preliminary deductions to representatives of other interested organizations. Accordingly, invitations were issued to twelve societies and associations requesting them to consider the proposed lists of standard sizes and to appoint representatives to confer with the committee before its report was finally formulated. The seven organizations listed below responded, and the standard sizes which follow have the unanimous approval of these representatives and, as far as can be learned, of their associations: American Hardware Manufacturers' Association; American Railway Engineering Association; American Supply & Machinery Manufacturers' Association; National Association of Manufacturers of U. S. A., National Association of Purchasing Agents; National Machine Tool Builders Association; and Southern Supply & Machinery Dealers' Association.

Report on Shafting Sizes

On January 14 the committee submitted to the council a report in which it recommended the approval and adoption of the following lists of sizes as standard for the society:

Transmission Shafting—15/16, 1 3/16, 1 7/16, 1 11/16, 1 15/16, 2 3/16, 2 7/16, 2 15/16, 3 7/16, 3 15/16, 4 7/16, 4 15/16, 5 7/16, and 5 15/16 inches.

Machinery Shafting—Size intervals extending to 2½ inches, by sixteenth inches; from 2½ to 4 inches inclusive, by eight inches; and from 4 to 5 inches by quarter inches. The council approved the report and accepted the recommendations.

THE CHILEAN NAVAL COMMISSION AT COWES

Admiral Luiz Gomez, chief of the Chilean Naval Commission now in this country, accompanied by Commander Julio Merino, a member of the commission, paid a visit to the works of J. Samuel White & Co., Ltd., on Tuesday, May 4th, to inspect the work being carried out on the Chilean gunboats, Lencoton, Elicura, Colocolo, and Crompello, preparatory to their return home from active service in the cause of the Allies in European waters.

The Admiral, after a tour of the company's shipyard and engine works, during which he made his inspection of the gunboats, expressed himself as highly satisfied with the work now in progress for his Government.

A new form of black japan, in which a non-combustible solvent is employed, has recently been brought out in America. The material, is, in fact, an emulsion of the asphalt oil base with water. It is stated that this japan has no tendency to settle out, even after months of storage, and that, owing to its being suspended in water, losses by evaporation are practically negligible. The japan is applied to small articles by placing them, charged positively, in a negatively charged iron tank of japan. An even, smooth coating of japan is deposited on the articles, and since the japan is deposited free from solvent, there is no resultant drip when the lot is conveyed to the baking ovens. In the case of large articles the metal is pre-heated before dipping.

Eastern and Western Canada Marine Activities

JUNE CORRESPONDENCE

British Columbia.

THE Esquimalt navy yard, ordered closed by the Dominion Government, March 15, will shortly be re-opened and placed under the charge of a new staff headed by Commander H. E. Home, formerly commander of the Canadian cruiser Rainbow, who succeeds Captain Edward H. Martin, R.N.

According to news brought from Ottawa by J. C. McIntosh, Member of Parliament for Nanaimo district, a new cruiser will shortly be brought around to Esquimalt as part of the Canadian Government's naval protection scheme.

It was hinted at in this column a month or so ago that the reason for closing the navy yard was mainly to give an opportunity of changing the personnel and making other changes in the general organization of the base. This has now been borne out by the announced intentions of the Government to partially re-open the base and station a cruiser there. The navy yard was taken over by the British Admiralty in 1857, but it was not until the following year that the base was actually established. The dry-dock was finished in 1886 and was first used in 1887. The yard was closed by the Admiralty in 1905 and subsequently taken over by the Dominion Government.

Preliminary construction work on the new dry-dock at Esquimalt, which will probably cost $8,000,000 before completed, will start in September, according to advices from Ottawa.

A delegation sent to Ottawa by the workers in the Harbor Marnie Company's steel shipyard, Victoria, has returned with word that the Government does not intend to place any more steel ship contracts with Canadian yards now that the present programme has been completed.

According to Mr. McIntosh, M.P., the Dominion GoGvernment is likely to reach some agreement with the French Government shortly, by which it undertakes to guarantee bonds aggregating $40,000,000 for steel shipbuilding contracts to be placed by the French Government with Canadian yards. In case this plan is carried out, it will mean new work for all established steel shipyards in Canada.

Longshoremen at Prince Rupert have gone on strike, demanding higher wages than are being paid the same class of labor in Victoria and Vancouver. The demand was made June 5, and as soon as the thirty days' notice expired the men walked out. Business men have undertaken to do the work while the strike is on.

Dominion Government engineer A. D. Swan, has recommended to Hon. C. C. Ballantyne, Minister of Marine, that a certain tender be accepted in connection with the dredging and filling of the site for the big Government pier in Vancouver, and the contract will probably be awarded in a few days.

Iron from the hull of the barque Carelmapu, which was wrecked off the west coast of Vancouver Island in the fall of 1913, is being shipped by the Takai Maru to Japan, where it has been purchased. The Carelmapu was built of Scottish iron and launched as the Janet Ross. She was later disposed of to Chilian interests.

Tonnage prices today are too high, in the opinion of Captain Robert Dollar, head of the Dollar Steamship line, who was in Vancouver recently. He stated that at the present time the sailings of Dollar ships are too far apart, now that the company has inaugurated the New York service, and that he intends to purchase three or four vessels in the United Kingdom, if the price is right. He believes that freight rates of the future will not justify the purchase of vessels at the present high price of tonnage.

A heavy charge of dynamite blew to pieces the hull of the schooner Janet Carruthers, June 15. Over a year ago the vessel was wrecked on the beach near Aberdeen, Wash. A wrecking and junk company purchased the vessel with a view to securing the metal fittings and bolts from her timbers. The salvagers expect to get 100 tons of bolts and fittings from the hold.

Inaugurating the double Summer service to Alaska, the Canadian Pacific steamship Princess Alice left Victoria a few days ago for Skagway. The boat will make five trips to the north this summer, the last sailing from Victoria being scheduled for August 6.

It is reported that the Coughlan shipyard in Vancouver may be included in the vast merger of steel, coal and shipping interests recently negotiated in the east by Colonel Grant Morden, J. J. Coughlan, head of the big Vancouver shipbuilding firm, has been in the east for some time, and it is said that his business has been largely in connection with the merger, already believed to involve interests valued at more than $400,000,000.

The Isthmian Line, according to a ruling of the United States Interstate Commerce Commission, may operate its fleet of liners between Atlantic and Pacific ports via the Panama Canal. There is an American law, known as the Canal Act, which prohibits companies owning railways from operating in this trade, and the Isthmian Line happens to be controlled by the United States Steel Products Company. However, it was pointed out that the law was framed particularly to prevent transcontinental lines operating fleets of steamers through the canal to curb competition. The United States Steel Products Company owns a few railways, but they are in no sense transcontinental, and therefore the Isthmian Line does not come within the application of the act. Fourteen steel steamships, one of the greatest fleets under the American flag, will be operated by the line between New York and Puget Sound and British Columbia ports.

The strike of sailors, firemen and stewards' unions, which held up coastwise shipping in British Columbia for about two weeks, came to an official end May 28, when the men voted practically unanimously to resume work. The strikers gained virtually none of their points. One of the principal points at issue was the demand of the sailors for an eight-hour day, as against the two-watch system of six hours each watch. The settlement on this question was a decision to continue the two-watch system, and to inaugurate a forty-eight hour week, but with overtime for work performed in excess of 48 hours. The Grand Trunk Pacific and the Union Steamship Company of British Columbia, were the principal companies involved in the strike. The companies some time ago agreed to increase the wages of seamen, firemen and stewards to the extent of ten dollars a month, and this is now being paid. Open shop conditions will prevail under the agreement arrived at, following the decision to resume work.

Seven 10,000 ton freighters of a fleet of 50 ordered in Japanese shipbuilding yards by the Nippon Yusen Kaisha for delivery within the next few years, will be placed in the trans-Pacific run, according to M. Watanabe, manager of the Seattle branch of the company. Mr. Watanabe also announces that the plans of his company for three palatial passenger lines each of 20,000 tons, are now being rushed to completion in Japan and as soon as ready for operation will be placed on the Yokohama-Seattle-Victoria service. Mr. Watanabe says that his company is not alarmed by the decision of the United States Shipping Board to place five passenger vessels on the trans-Pacific run between Seattle and the Orient. He explained that the growth of travel, as a result of the stimulated commercial relations between the United States and the countries of the Far East, would absorb all the shipping facilities likely to be provided within the near future, and he believes that there will be enough business to divide between the Shipping Board and private lines, with a considerable surplus left over.

Montreal

Midsummer activity is now effective in and about the port of Montreal and the harbor has every appearance of pre-war days. Many new vessels have come to port, while others that were frequent callers, are obviously absent, due to changes following war conditions. Considerable interest is displayed in the passenger service, as every boat leaving Montreal is invariably loaded to capacity, and this is particularly true to west bound incoming vessels, the outcoming

passengers of the settler type being above the average. Shipbuilding in this district was slightly curtailed during the month due partly to local trouble in steel foundries, and partly to inadequate delivery of other ship materials.

The American Water Works' Association are holding their 40th annual convention in Montreal this week. Delegates to the number of over 800 are in attendance, and the business meetings are being held at the Windsor Hotel.

McLean Kennedy, Limited, as agents for the Houston Line, announce the opening of a new service between Montreal and Port Said, Aden, Bombay, Singapore and other ports in the Far East. The steamer Clan Campbell will inaugurate the service by sailing from this port about the middle of July.

The new addition to the plant of the St. Lawrence Welding Company has been completed and new machinery has been installed. A set of 8 ft. bending rolls, capable of handling 1-inch plate, has been added to the equipment. Several new machines have also been provided in the machine shop.

The commencement of the practical training as a result of the scheme of the Canadian Government Merchant Marine for the apprenticeship of boys in the mercantile service, has just recently been made. Two boys have been placed on the Canadian Navigator and a third has been indentured on the steamer Manoa of the Canada Steamship Lines. These boys have received their preliminary training with the Boys' Naval Brigade of the Navy League, under the command of Capt. H. S. Matthews.

Hans Renold, of Canada, Ltd., have opened their offices in the Marconi Building, 11 St. Sacrament Street, Montreal, This company was recently organized to be the sole Canadian representatives of the Hans Renold, Ltd., of Manchester, England, so that dating from June 1, all enquiries regarding Renold steel driving chains and wheels should be made to the above address. Mr. H. George, formerly with Jones and Glassco, will be the managing director.

The Canadian Northern Railroad is negotiating with the city of St. John, N.B., for permission to place additional tracks on Water Street, in order to facilitate the handling of incoming and outgoing freight. The railroad is evidently preparing to increase the docking accommodation in the vicinity but it is not expected that this will be done this year. The city officials are favorably impressed with the proposal, as the added shipping facilities would mean increased trade to the port.

New appointments on the staff of the Canadian Merchant Marine, are as follows: H. Melbourne has been appointed to the position of assistant to the manager, and Capt. E. E. Tedford has assumed the position of marine superintendent, with headquarters at Montreal. Capt. Tedford is a Yarmouth, N.S. man, and has had considerable experience in sailing on Canadian vessels, and most recently has served as marine superintendent for E. C. Downing, of Cardiff, England. Capt. L. M. Hatfield, also of Yarmouth, has been appointed assistant to Capt. Tedford.

A new steamship service that will be known as the Ellerman-Bucknall Canada-India-Java Service, has been inaugurated to operate a direct line of steamers between Montreal and the Far East. The New Zealand Shipping Company will be the Montreal agents for the line. The service will be commenced by the sailing of the British steamer Katuna, of 8,500 tons, from Montreal about the end of July, to be followed shortly afterwards by other vessels. The company opening this service is one of the largest steamship companies in the world, having service to all parts of the globe.

The launch of the Canadian Victor from the yard of Canadian Vickers, Limited, on Tuesday, June 22nd, is the third that has been made from this plant this spring, the other two being for Norwegian interests. This is the first vessel for the Canadian service that has been launched from Vickers this year. At the present time there are three others under construction for the Canadian Government and two more for the Norwegian companies, all of which will be in the water before the close of navigation this year. The total tonnage from this yard this year will be about seventy-thousand tons.

The visit of H.M.S. Calcutta to the port of Montreal, was the subject of considerable interest during the early period of the month. The vessel came to this port so that Rear-Admiral Sir Alan Everett could attend the conference held at Ottawa. The Calcutta is the flagship of the Eighth Light Cruiser Squadron, and is one of the most modern of the class to which she belongs, having been launched in July, 1918. She is 450 feet in length and carries a crew of 26 officers and 300 men. The armistice came along before the vessel was in commission and in view of this fact, she was modified for peace routine duties. She is fitted with five 6-inch guns, eight torpedo tubes, and various small armaments.

The Canadian Government Merchant Marine have made the announcement that they will enter Martinique as a port of call on their West Indies route. It is also hoped that the Islands of Guadeloupe and Hayti will be included in the service that has been started between Montreal and the West Indies. The first steamer to make this trip taking in the new ports, will be the Canadian Runner, which is now building on the Great Lakes and which will come down to Montreal in time to make the first sailing about the end of July. The product sent from here will include flour, meat and manufactured articles, and it is hoped that cargoes of sufficient size, in the way of sugar, rum and other West India products, may be secured to warrant the continuance of the service.

The City of Montreal has just closed a contract with the Montreal Light, Heat, and Power Company, for power to operate the electric units that will be used for the pumping of water at the Low Level Pumping Station. The contract is for a minimum amount of 4,000 horse-power at a maximum rate of $25, the period of the agreement to be 25 years. This is the result of negotiations that have been carried on for some time in connection with the installation of motor-driven pumps in place of the steam ones now in use. Two of the new five 30 million-gallon pumps that will eventually be provided are expected to be in operation this summer.

The extensive program of the Canadian Government Merchant Marine is shown in the recent announcement of R. B. Teakle, the general manager, to the effect that contemplated additions to the service would mean that the activities would eventually be the encircling of the globe with steamers of this service. The latest addition to the service is that recently inaugurated in the establishment of a service from Eastern Canada to India and other ports in the Far East. Following this, it is hoped to commence a line of steamers sailing from the West Coast to China and Japan. The Canadian Conqueror, a vessel of 8,400 tons will open the service from Montreal to the East about the end of August; this vessel is now building at the yard of Canadian Vickers at Montreal.

At the conclusion of a tour of inspection of Canadian shipyards Sir James McKenzie, managing director of Vickers Ltd., of England, stated: "I am surprised at the magnitude of these yards and also at the economic layout of the plants, and I have seen the most modern machinery in these plants that exists anywhere today, and for the first time in my life I am ready to admit that there is a great future for the shipbuilding industry of Canada. I have no hesitation in saying that the acquisition of the companies owning these plants is absolutely essential, in my opinion, to the existence of the British Empire Steel Corporation. It will only be following out the same lines as have been adopted by the United States Steel Corporation and our big steel interests in England, where they have control of their shipping and shipbuilding plants."

St. John, N.B.

Although there is not a man on board, the three-masted schooner B. B. Hardwick, of Annapolis (N.S.), is still sailing the Atlantic. The schooner was battered by a storm six months ago and abandoned by the members of the crew, who were rescued and returned to their homes. The Hardwick was sighted off the Nova Scotia coast a few days ago. Her sails, although set, were torn.

Arrangements are being made to place an additional steamer on the St. John-Boston route in order to handle the heavy passenger traffic of the summer months. At present the S. S. Governor Dingley is handling the business.

The winter port business of St. John (N.B.) has been completed for this season.

MARINE ENGINEERING

AND

Canadian Merchant Service Guild Review

A monthly journal dealing with the progress and development of Merchant and Naval Marine Engineering, Shipbuilding, the building of Harbors and Docks, and containing a record of the latest and best practice throughout the Sea-going World.

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The Merger Goes On

IT would appear now that the opposition to the formation of the British Empire Steel Merger had been overcome at least for some time. This opposition was being directed chiefly by the late president of the Dominion Steel Corporation, and he was supported by several of the directors of the corporation. The objections held by these gentlemen were not against the merger itself, but against the inclusion of some of the smaller companies which it is proposed to include. At the annual meeting recently these directors all spoke, and demanded more information, claiming they were safeguarding the interests of the shareholders. However, the result of the meeting was the election of a new board of directors, which did not include any of those protesting. It was stated by Col. Grant W. Morden that ample opportunity would be given shareholders to approve or disapprove the amalgamation at a later date.

The formation of this great combination of interests holds such possibilities for our future trade, that given sound financing, its success is assured. Where steelmakers are combined and shipowners have to buy from them, it makes for high prices of steel and ships. If, however, steelmakers and shipbuilders are both actuated by the same interests, it makes for cheaper ships. That is only one aspect of the case. The most promising thing is that with the capital that would be made available the natural resources of the coal and iron districts of Nova Scotia would be developed in a manner that has not yet been approached. We are not among those who see nothing but evil in mergers or trusts, but on the contrary, believe that the solution of the high prices of commodities will be found in the reduction of production costs, made possible by combinations of capital and management. In the engineering field, the most efficient use of the various types of works is made possible by this means, and it is a significant fact that most of the leading engineering firms in Great Britain are now amalgamated, as the result of the conditions prevailing since the armistice.

Artificial Feeding

IT would seem that the new United States merchant marine, having been brought into life very hurriedly, now requires some more than ordinary stimulus to keep it living. The Jones Act, which has recently passed, provides for the abrogation of all treaties which prevent discriminatory duties being imposed on foreign ships, and also prevents United States goods being carried from a U. S. port to another U. S. port via a foreign port in any but a vessel flying the U. S. flag. This would appear to be aimed particularly at the trade which has developed between U. S. ports and Alaska over Canadian railways and by Canadian steamers. The whole measure seems to be a tacit confession that, left to itself, the U. S. merchant marine cannot survive, and that to ensure its prosperity open competition must be eliminated. Whether the course pursued is a wise one is open to doubt. It is not to be supposed that other nations will sit quietly by and see their ships practically barred from United States ports, and still allow vessels of that nation to come and go freely where they list. If a policy of retaliation should be adopted by the maritime nations who are the chief competitors of the United States, it is conceivable that the Jones Act could become a very efficient boomerang. The new merchant marine of our neighbors can become a successful trading fleet only if it can join in world trade, and it would be a comparatively easy matter to effectually bar it from a large portion of the world's ports, to say nothing of coaling and oil fueling stations. It is to be hoped that the formal representations that will doubtless be made by the interested nations to the U. S. Government will result in a modification of the new act, and that a commercial war with all its dangers may be avoided.

British Steel Tonnage

THE way in which Great Britain is coming back into the iron and steel markets of the world is a matter of surprise. There have been all sorts of obstacles thrown in the way. There have been strikes of all sorts, lock-outs and transportation troubles, but against all this there has been steady and determined progress, until now her production is greater than the record-breaking months of 1918.

For the first five months of this year the British steel output has been at a greater yearly rate than the total for any calendar year, or at a rate of 9,672,000 tons as against 9,591,000 in 1918 when the pressure of war necessity was driving production figures to new levels.

Before the war Britain's production of iron was greater than that of steel, but now the figures have been reversed.

A fairly large tonnage of British high speed steel is again going into the American market, from which the British makers had to withdraw during the war.

Britain's recovery is well shown in the steel tonnage records she is hanging up through all her troublesome days.

An idea of the amount of money the people of New York City are spending for amusement can be gleaned from figures made public by William H. Edwards, Collector of Internal Revenue, which show that the theatres of Manhattan collected $783,891.42 in war taxes during January and $695,626.70 in February. The tax on all theatre tickets is 10 per cent., so Mr. Edwards' figures indicate that the income of Manhattan theatres during January was $7,838,914.20 and the following month it totalled $6,956,-267. The collector declared his office checks up all box office receipts and that the auditors have not discovered any attempt to cheat Uncle Sam.

PROGRESS IN NEW EQUIPMENT

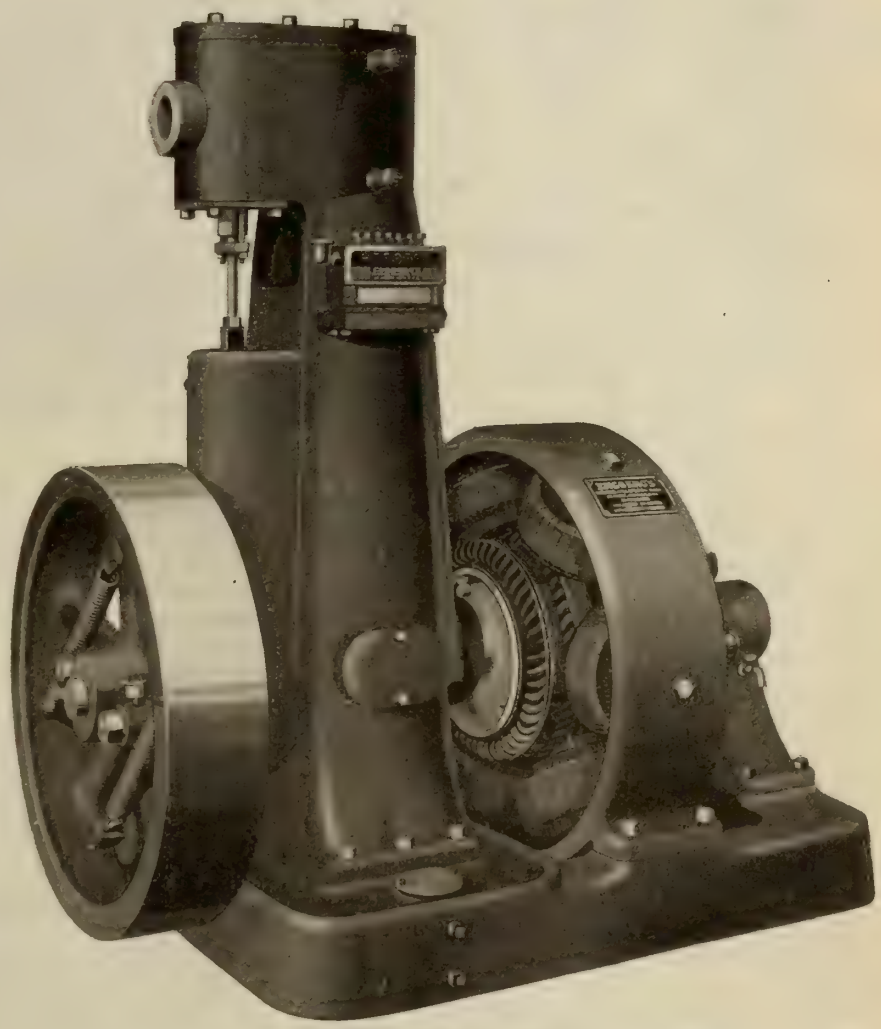
There is Here Provided in Compact Form a Monthly Compendium of Shipbuilding and Marine Engineering Auxiliary Product Achievement

THE ENGBERG DIRECT-CONNECTED LIGHTING SET

The Engberg Electrical and Mechanical Works of St. Joseph, Michigan, have developed, for marine purposes, a very neat and compact engine and generator set. While space has been economised on to the limit, the necessary accessibility has not been sacrificed in any particular. To enable the working parts to be easily reached, doors are provided, one of which gives access to the crosshead, wrist pin, and adjacent parts, the bottom end of the rod being reached through hand holes. Great care has been expended on the material and workmanship entering into these sets, and the makers have sufficient confidence in them to agree to replace any part that proves defective within one year from date of shipment, while under normal operation. Great care has been paid to the design of the details, such as pistons, connecting rod, etc., the connecting rod particularly being built with a view to securing great strength and ample bearing surfaces. The rod is rectangular in shape, and in the smaller sizes is drop forged, the larger ones being made of cast steel. The lubricating system, which is of such great importance in a high speed, enclosed type of engine, is of the positive type. A pump is situated in the base of the engine, which lifts the oil from the base reservoir to a trough on the side of the engine frame. From this trough the oil is distributed through sight feeds to each bearing. These feeds are adjustable. The oil after going through the various bearings, is drained into the base, where it is filtered and pumped up over again. The feed pipes are made of such liberal size as to ensure a constant spray of oil being thrown over the moving parts, in addition to the direct feed. Each engine is put through an exacting running test before leaving the shop, and is thus in perfect operating condition when it reaches the customer.

The generator is of the compound wound direct connected type, and is guaranteed for one year in the same manner as the engine. They are built to satisfy the standard of the American Institute of Electrical Engineers. The shunt and series coils are impregnated with a waterproof compound by a vacuum process, after which they are baked. This compound is a good heat conductor, and thus materially assists in carrying away any heat generated at the centre of the coil, besides which it acts as a protection to the wire. It is hardly necessary to state how important protection against moisture is in marine service. The commutators are assembled in a special chuck, which is heated and expanded, the screws being then pulled up tight. The cooling off and shrinking of the chuck draws the commutators into a true and permanent position. Before assembling, the commutators receive heat treatment at a considerably higher temperature than they are ever liable to receive in practice.

The whole set is a very good example of this type of auxiliary machinery for marine purposes.

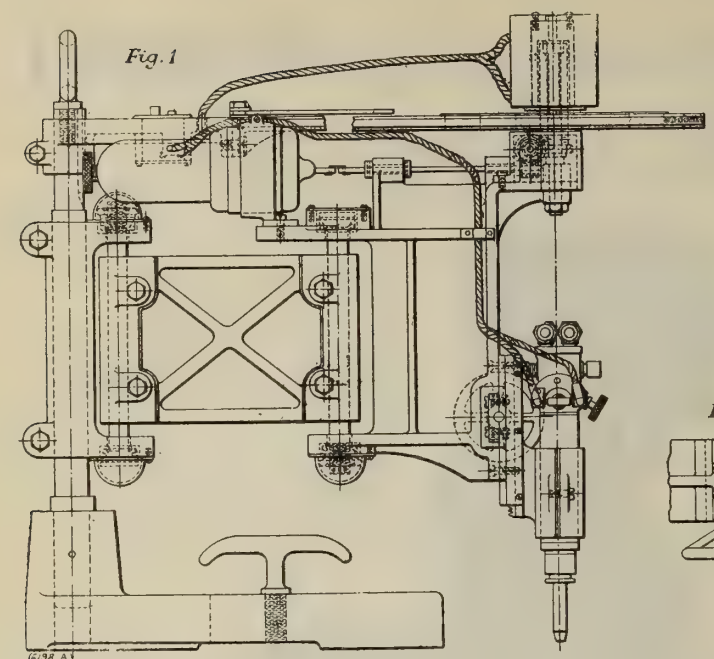


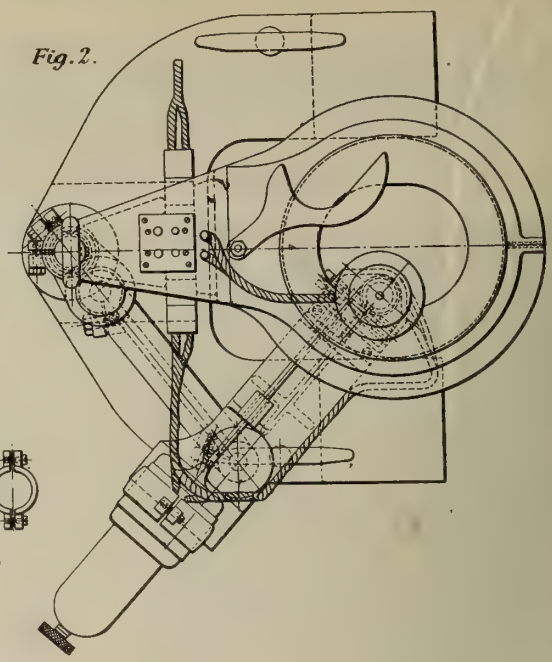
GENERAL VIEW OF ENGINE

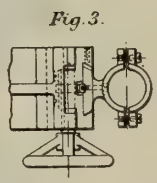
OXY-ACETYLENE MANHOLE CUTTING MACHINE.

An interesting application in automatic cutting by the oxy-acetylene process is exemplified in the illustrations Figs. 1 to 4, annexed. The appliance illustrated is intended for the repetition cutting of manholes to template. It is made by the Davis-Bournonville Company, Jersey City, N.J., U.S.A., and has been styled by them the Camograph No. 2. The firm some time ago produced a machine with a tracing wheel, by means of which the torch could be made to follow a blue print. In the present machine the action is automatic, the torch following a cam or template.

A heavy cast-iron base of U-shape is provided, at the back of which is a vertical post. On this post is pivoted a double-jointed arm consisting of two leaves. These are light but rigid aluminium castings, and are mounted on ball bearings, which are also used for the hinge joint between them. The cutting torch is mounted pointing vertically downwards, on the lower outer end of this double-jointed arm, as will be clear from the photograph reproduced. The automatic movement or feed is obtained by the gear at the top of the machine. Fastened to the post is a large frame or holder in which is a circular opening. In this opening can be fixed cam plates cut to the form of the manhole it is desired to cut in the work. On the top of the outer leaf of the double-jointed arm is a small motor, driving a spindle, which, by worm and double-reduction gears, drives a small feed roller mounted exactly on the axis of the torch. This feed roller is in contact with the cam face, and therefore guides the torch along the required path.







FIGS. 1 AND 2.

The feed is actually obtained by friction, the necessary adhesion of the roller on the cam face being obtained by a powerful electro-magnet, which is shown above the cam plate holder. This magnetises the feed roller, and it is drawn towards the cam face, against which it rotates. Direct current is required. The control is by a double push button switch for starting and stopping the motor, and for energising the magnet. Speed control is affected by means of a small knurled screw on the end of the motor casing. The electric control is connected up with the oxygen valve so that when the oxygen supply is turned on for cutting the feed motion starts.

This machine was originally designed for cutting hand holes, etc., in ship and boiler plates. It has immense advantages over the drilling machine, for it can be placed in any position on a large plate which would otherwise involve the use either of a large machine tool, or a portable tool with necessary preliminary drilling. In addition, of course, the finish obtained with the torch is so much better than that with a series of drilled holes, as frequently to require no subsequent dressing up. Very little power is required to drive the machine, which is designed to cut openings of about 7 in., though holes with one dimension considerably larger than that may be cut. A hand hole having a periphery of 12 in. to 13 in. can be cut in ½ in. to ⅝ in. steel in about a minute. All ordinary thickness of boiler plate may be cut. The shape of the hole is dependent upon the cam. The cam plate can be replaced by another practically without loss of time. Care must be taken when perforating and cutting plates in this manner, to perforate well inside the finishing line, in order to obtain a clean contour finish. A secondary cam is provided to guide the feed roller after perforating up to the main cam face.

The machine weighs 125 lbs. It is provided with an eyebolt at the top of the pillar, so that it is easily slung. It is about 25 in. high and 17 in. wide. The motor and magnet require a supply of direct electric current at 110 volts.

The most valuable "system" is a good nervous system.

—o—

He—"The hand that rocks the cradle rules the world."

She—"Then you come here and rule the world a while. I'm tired.

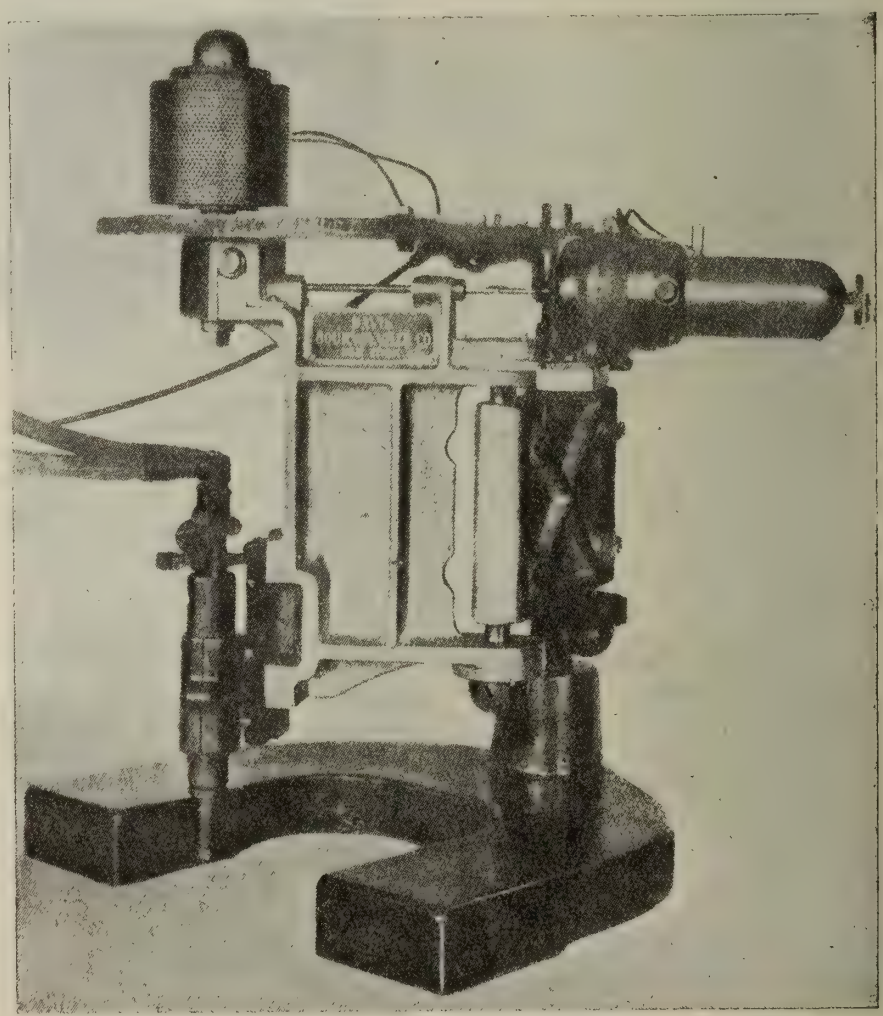
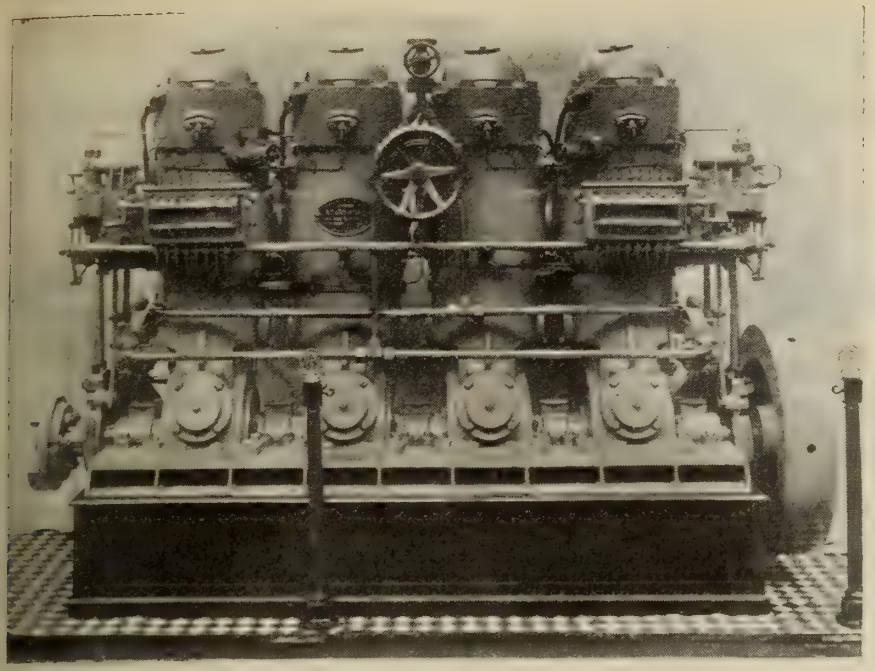


FIG. 4.



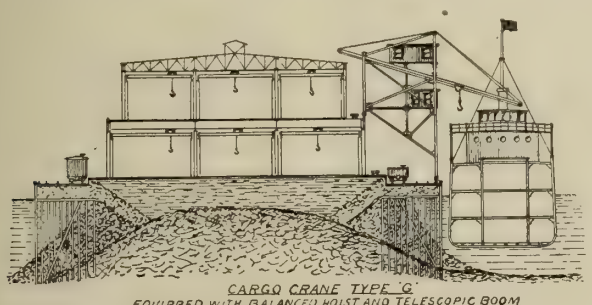
120 B.H.P. BEARDMORE OIL ENGINE.

THE BEARDMORE OIL ENGINE

Wm. Beardmore & Co., whose works are famous all over the world where engineering is spoken of, are now manufacturing a two-cycle crude oil engine, which is suitable for either stationary or marine purposes. The engines are built in sizes of 10 B.H.P. to 500 B.H.P. and of one to six cylinders. The illustration herewith shows a four-cylinder two-cycle engine of 120 B.H.P. The materials employed in the construction of these engines all comes from one or other of the Beardmore works, and this feature makes the firm entirely independent of outside manufacturers. Every engine is tested before being sent out, and it is the company's rule to have the purchaser or his representative present at these tests. Lubrication is performed by forced feed, through a sight feed box. An interesting fact is that this type of engine has been chosen for the vessel which is carrying the British Imperial Antarctic expedition, which leaves shortly for five years' Antarctic exploration. Messrs. Beardmore & Co. are building the engine free of profit, and have also contributed generously to the funds.

NEW TYPE OF CARGO CRANE

The Herbert Morris Crane Co., Niagara Falls, Canada, have recently developed and put on the market a new type of cargo handling crane, which is suitable to all cases where a vertical lift and a horizontal travel are required. A single drum is used to accomplish these two movements instead of the usual two drums. A pair of rope grips, controlled by a lever, accomplish the horizontal movement.



CARGO CRANE TYPE 'G' EQUIPPED WITH BALANCED HOIST AND TELESCOPIC BOOM

An important feature of the hoist is that the dead load of the bucket or skip, and half the weight of the live load is balanced by a counterweight, which materially reduces the power required to make the lift. This again allows of a smaller motor or engine being used than is the case in the ordinary type of crane. When a load is being lowered, the motor has to work to raise the counterweight, and in this manner a much better control is exercised than with the braking action usually employed. No friction clutch is used, the hoisting drum being rigidly keyed to the shaft. Another improvement introduced in this type of crane is an extensible or telescopic boom, which can be shortened or lengthened as may be required. The slack of the hoisting rope is taken up by the counterweight when the boom is pulled in. The crane can by this means handle freight on the pier as well as from the ship to the pier.

These cranes are made in three types. There is the half gantry design, with the short leg running on the roof of the freight shed. This crane can handle goods through hatches on the roof of the freight shed to and from the ship. The second type is of full gantry design, equipped with an extensible boom, which is inclined. A third type is of full gantry design, with one leg on each side of the freight shed. It is equipped with a double extension boom, and can handle freight from each side of the pier, to or from the opposite side, or into the freight shed. Our illustration shows a half gantry crane, equipped with balanced hoist and telescopic boom.

TRADE ANNOUNCEMENTS

The Westinghouse Electric & Manufacturing Company announces that it has been awarded the contract to supply the propelling machinery for the two new freighters being built for the Matson Navigation Company at the yards of the Moore Shipbuilding Company.

These vessels will be 497 feet long overall, have a molded beam of 62 feet, and a dead weight capacity of 14,000 long tons at a draft of 30 feet. They are specially designed for the rapid and economical handling of cargoes, the machinery being placed aft and the holds arranged with minimum obstructions and a maximum of hatches and ports.

The propelling equipment of each ship will consist of a 5,000 S.H.P. Westinghouse turbine, consisting of a high pressure and a low pressure element which will drive the propeller through a common floating-frame gear. This gear is to be of the double-reduction type, reducing the turbine speed of 3,500 R.P.M. to 95 R.P.M., a ratio of about 37 to 1. The speed of the ship will be 12½ knots.

Each turbine element can be operated separately, if the other is out of commission, and both contain astern elements giving 40 per cent. of ahead power. Additional nozzles are provided on each turbine to permit of an increase of 20 per cent. of the turbines power in case either steam pressure or vacuum (or both) should fall below normal.

The boilers will be oil-fired and will carry a steam pressure of 225 lbs. The superheat will be 50 degrees, and the vacuum, 28½ inches.

In addition to the turbines and gears for these vessels, the Westinghouse Company will also furnish the air ejectors, air separators, condensate pumps, and other auxiliaries. The condensers in each ship will have a condensing area of 10,500 square feet.

H. G. Trout & Co., Buffalo, U.S.A., have issued a well illustrated catalogue describing their equipment and marine steam engines. The foundry is capable of melting 30,000 lbs. bronze in one heat, and 50,000 lbs. semi-steel in one heat. The daily capacity of semi-steel castings is 60 tons. The foundry is backed up by a well equipped machine shop. The catalogue gives a number of illustrations of individual machines, and much general information regarding the shops.

MARINE NEWS FROM EVERY SOURCE

Amherst. — The tern schooner Burpee L. Tucker was launched recently from the yard of George E. Wagstaff, Port Greville. She is a vessel of 465 tons register, and is fitted with auxiliary hoisting power and all modern improve-

St. Thomas.—Work on the harbor of Port Stanley will be started immediately according to officials of the Federal Government. The turning basin, channel and outer harbor will be dredged and the most dangerous portion of the submerged east pier will be removed. Work will also be resumed on the west pier.

Port McNicoll.—The Canadian Pacific Railway announce the opening of the season on the Port McNicoll and Fort William service on May 1st. There will be five sailings each week from then on. Freight for Port Arthur, Fort William, and all points to the Northwest is now being accepted for routing via Port McNicoll.

Detroit.—Wireless and radio compass stations will be erected at Devil's Island, Eagle Harbor, Marquette and Whitefish Point on Lake Superior for assistance to navigation and for aid to life saving. These improvements in navigation aids follow a long period of agitation, especially after great disasters to shipping.

London.—Sir Alfred Booth, speaking at a meeting of the Cunard Steamship Co., said that the company were quite prepared for a slump in freight rates, and that the sooner the storm was over the better. He expressed the hope that the break in freight rates would also break the vicious circle of rising wages and rising prices.

The Naval Service, at Ottawa, is receiving tenders up to August 2 for the following ships: Niobe, steel cruiser, armored; Rainbow, steel cruiser, which could be used as a cargo vessel with slight alterations; The Grilse, oil burning steel pleasure yacht; Canada, steel, built in 1904. The Rainbow is lying at Esquimalt, B. C., and the others at Halifax.

Montreal. — Canada Steamship Lines, according to Mr. W. J. Norcross, is looking forward to a very successful season. The bookings in advance for the tourist season are larger than ever before at this time of the year, and the freight business was holding up its end in a splendid way. The company is also reaping the benefit of the long term charters made when conditions were so acute.

Haileybury. — The Upper Ottawa Improvement Company have adopted oil fuel for one of their steamers, the "Alexandra." This boat recently arrived in Haileybury on her first trip, having made the trip from the foot of the lake in five hours and twenty minutes, which is a considerable improvement on the time occupied by her when burning wood fuel. The other steamers of the company will be equipper with oil burning apparatus in the near future.

Kingston.—Capt. William Leslie will leave shortly to resume operations on the raising of the sunken steamer Keystorm, off Scow Island, opposite Chippawa Bay, Capt. Leslie is making all the necessary preparations for getting at the work again. It will be recalled that the Keystorm, some few years ago, struck a rock and sank while en route to Montreal with 2,500 tons of soft coal. Examination of the wreck made by the divers showed that a large hole had been torn in the side of the vessel.

Halifax.—It is freely stated around the port of Halifax that there will shortly be a new fast Atlantic service in force. The capital, which is said to involve millions, is to be British and Canadian. A fleet of super-passenger vessels, oil burning, and about one knot faster than the "Lusitania," will be put on the service between Halifax and an English port, and the journey will only involve three nights at sea. While these ships are building, three modern passenger boats of ordinary speed will be put on the service.

Hamilton.—In preparation for the widening and deepening of the Welland Canal, Hamilton has plans made involving the expenditure of $20,000,000 for improvements to the harbor. At the recent session of the Deep Waterways Commission Hamilton's claims were strongly urged. Hamilton at present handles 125,000 tons annually of steel, pig iron, and agricultural implements on its docks, besides 7,000,000 feet of lumber. With the completion of the canal, the tonnage is expected to reach one and a half millions annually.

Montreal. — Four more ships for the Canadian Government Merchant Marine will be delivered shortly. Some of them would have been already handed over had it not been for labor troubles in the yards where they are building. The Collingwood Shipbuilding Company expect to deliver the "Canadian Observer," 3,900 tons, while the "Canadian Trapper," 5,100 tons, will be coming from the Davey Shipbuilding Company at Levis. The "Canadian Rancher," will be delivered from the Three Rivers yard, and the "Canadian Volunteer," which has been under repair will soon be in service again.

St. John, N. B.—At the annual meeting of the shareholders and directors of the St. John Drydock & Shipbuilding Company, James Playfair, of Midland, Ont., was elected president; D. S. Pratt, of Midland, vice-president and managing director, and Col. Thomas A. Duff, of Toronto, secretary. Other directors were elected as follows: D. L. White, jun., Midland; W. P. Phin, Hamilton, Ont.; W. J. Sheppard, Waulbaushene, Ont.; and James B. Craven, New York. It was announced at the meeting that the company had purchased a hydraulic dredge of Canadian register to work here.

To Aid Shipbuilders.—A resolution designed to assist shipbuilding yards in carrying out their contracts for vessels over 3,000 tons, has been placed on the order paper of the Commons in the name of Sir Henry Drayton, Minister of Finance. The resolution provides that the Minister of Finance may be authorized by the Governor-in-Council to endorse promissory notes drawn by the purchaser in favor of the shipbuilder for fifty per cent. of the purchase price where the remaining half of the cost has been provided for. The vessels will be mortgaged to His Majesty for the full amounts of the notes so endorsed and fully insured. and the vessels shall be registered in Canada and the register shall not be transferred until the mortgage has been cleared off.

PERSONAL

Mr. Harry A. B. Fales, of Frank Fales & Sons, 61 Dock Street, St. John, N.B., has sailed for England, where he will interview the leaders in the English, French and Norwegian fishing trade. Mr. Fales, whose firm represents Henry Milward & Sons, Redditch, Eng., manufacturers of fish hooks and tackle, Messrs. Hounsell's, Bridport, Eng., manufacturers of lines and nets, and R. Hood Haggie & Son, of Newcastle on Tyne, will interview all these firms, and familiarize himself with methods of manufacture, etc., of the various lines. This knowledge will be of great assistance to his firm when he returns, as their business is entirely with fishing supplies.

GEARED TURBINE VESSEL FOR NORTH SEA

An important event in the progress of British reconstructive shipbuilding took place to-day, when a steel screw passenger vessel for Det Bergenske, Dampskibsselskab, Bergen was launched from the Walker Shipyard of Messrs. Sir W. G. Armstrong, Whitworth & Co., Ltd., of Newcastle-on-Tyne. Mrs. Lee, Lady Mayoress, of Newcastle-on-Tyne, gracefully named the vessel S. S. "Leda."

The "Leda," which is to run between Newcastle and Bergen, forms a powerful addition to the company's fleet; she is a finely modelled steamer with slightly larger accommodation and more speed than the S. S. "Jupiter," which, up to the present, has been the fastest steamer in this service.

The principal dimensions are as follows:

Length over all, 321 ft. 2½ in.; length between perpendiculars, 305 ft. 0 in.; breadth extreme, 41 ft. 9 in.; depth moulded, 20 ft. 6 in.; mean loaded draft, 17 ft. 0 in.

The vessel is of the two deck type, with combined poop and bridge, joined to the forecastle by means of two permanent gangways, the shell being carried up in way of the forward well to the line of the forecastle.

A promenade deck extends for about ½ length amidships covering the midship house, whilst above this is the boat deck, at the fore end of which is placed a house containing the accommodation for the captain and principal deck officers.

And after boat deck covers the house containing the stearing gear, third class entrance, and seamen's entrance.

The vessel is fitted out for about 100 first-class passengers, in 1 and 2 berthed rooms, placed on the upper and second decks. These state rooms are large and airy, are fitted up in first class style, and are in every way suitable for the comfort of the passengers.

A large dining saloon is fitted up at the fore end of the bridge deck, having seating accommodation for all passengers.

The main entrance of this dining saloon is carried up to the promenade deck from which opens a spacious lounge. The decorative work and fittings of the saloon, lounge and entrances are of elegant finish, the work being designed and carried out by the well-known firm of decorators, Messrs. Trollope & Colls, Ltd., of Liverpool.

The whole of the first-class accommodation is such as will appeal strongly to those crossing from Great Britain to Norway.

On the upper deck aft, accommodation is arranged for 47 third-class passengers in 2, 4, 5 and 6 berthed cabins, with two comfortable dining rooms, one on the upper deck, the other in the house on the poop deck.

On the bridge deck around the engine and boiler casing are housed the engineers and junior deck officers; here also are the mail room, post office, etc. Accommodation for the stewards and stewardesses is arranged at the after end of the first-class accommodation on the upper deck. The firemen are berthed on the second deck at the sides of the engine casing, and the seamen on the second deck aft.

An open air cafe is arranged at the aft end of the promenade deck.

The vessel is built to the highest class of Norske Veritas, and will be the first vessel in the North Sea to comply with the requirements of the London convention for safety of life at sea. The regulations of the Norwegian Board of Trade for passenger vessels have also been complied with.

Ample water ballast capacity is arranged for, in double bottom, deep tanks, side tanks, and fore and aft peaks, ensuring an equally good sea boat in the loaded condition.

Three cargo holds are arranged, each served by double derricks and double winches, so that cargo can be quickly shipped and unshipped. The ventilation arrangements are of the most up-to-date type. The first and third-class accommodation, seamen's and firemen's accommodation are ventilated and heated on the Thermo tank system, and arranged so that the air in each room may be continuously changed.

The deck machinery is of the latest type, the steering gear of Caldwell's make being fitted no the rudder head, with telemotor control from the wheelhouse amidships.

The vessel is fitted with electric light throughout, having duplicate plants together with emergency lighting and pumping arrangements, as required by the London convention.

Marconi wireless installation is also fitted.

The cooking and serving arrangements are of the very best description, designed so that food can be well and quickly served.

Special insulation is fitted to keep the various rooms at a uniform temperature in the coldest weather, and also to guard against overheating from the machinery and boilers.

The various regulations to guard against fire are being fulfilled, whilst life-saving appliances are in accordance with the latest requirements of passenger vessels; life boat accommodation is arranged for every person on board.

This vessel is of the single screw type, with turbine machinery driving the propeller shafting through gearing.

The turbines consist, both for ahead and astern going, of a high and a low pressure turbine, working in series. These turbines transmit their power through flexible couplings to pinions, which in turn drive the gearing, which is of the double reduction type.

This type of gearing makes possible a speed of rotation which is best suited both to the turbines and the propeller, resulting in a high overall efficiency being obtained; at the same time the revolutions of the propeller are about the same as would be run by machinery of the reciprocating type, the total reduction of speed between the turbines and propeller being effected in two steps.

When working at full power on service, it is anticipated that the turbines will develop about 2,800 shaft horse power at about 115 revolutions per minute.

The impulse type of turbine, having wheel stages throughout, has been adopted; the grouping is such as to produce practically an equal transmission of power through the high and low pressure turbines.

The adoption of high and low pressure turbines for astern going produces an arrangement which is conducive alike towards greater efficiency and immunity against total break-down.

The rotating portions of the turbines comprising the stage wheels and the spindles have been made entirely from ingot steel forgings, while the blading throughout is of phosphor bronze material.

The gear wheels and pinions are of the double helical type, the shape, size and pitch of teeth being made in accordance with what experience has proved to be satisfactory.

The wheel rims upon which the teeth are cut, together with the main shafts, are made from ingot steel forgings, while the pinions are of nickel steel.

For the efficient and silent running of such gearing, it is necessary that the means of lubrication should be as thorough as possible. For this purpose sprayer nozzles, distributed at suitable intervals, are arranged to spray the oil direct on to the engaging teeth, thereby providing a film of oil between the surfaces in contact.

All other bearings in connection with the turbines and gearing also work under a system of forced lubrication.

"The Michel" type of thrust bearing is used both in connection with the adjusting of the high and low pressure turbines, and the main thrust block.

The condensing plant is made capable of maintaining a vacuum of 28½ in., with the temperature of sea water at 60 deg. when the machinery is developing its full service power.

A very complete installation of auxiliary machinery is provided to cope with the whole of the engine room and deck requirements of a vessel of this class; this includes an auxiliary condenser of suitable size.

The boilers are of the multi-tubular type, single ended and three in number; they are arranged for working with Howden's system of forced draught. The working pressure of the boilers is 220 lbs. per square inch. An approved type of superheater is fitted in connection with the boilers, and the temperature of the superheated steam entering the turbines is about 200 deg. in excess of saturated steam.

Special attention has been paid to the provision of suitable materials which come in contact with the superheated steam, both in the boiler and engine rooms, and considerable attention has been given to the insulating of all hot surfaces, by the provision and application of special non-conducting materials. A fan arranged for driving by two engines, one being a stand-by, is fitted for supplying the air for the forced draught.

The chimney, of oval section with outer casing, carried the full height.

NOTICE TO MARINERS

No. 24 of 1920

(Pacific No. 6)

All bearings, unless otherwise noted, are given from seaward in degrees from 0° North) to 360°, measured clockwise, followed by the magnetic bearing in degrees in brackets, miles are nautical miles, heights are above high water of ordinary spring tides, and all depths are at low water of ordinary spring tides.

BRITISH COLUMBIA

(59) Strait of Georgia—Fraser River—Woodward's Islands; Deas Island; Tilbury Island and Annacis Island—Range lights established.

WOODWARD'S ISLAND RANGE LIGHTS.

Front Light.

Position.—On north side of the Woodward's Islands.

Character.—White acetylene light. automatically occulted at short intervals.

Elevation.—12 feet.

Visibility.—4 miles in the line of range.

Structure.—Pile dolphin supporting a white, wooden slatwork daymark and platform carrying tank and lantern.

Remarks.—The light is unwatched.

Back Light.

Position.—325 feet 99° (N.74°E.mag.) from front light.

Character.—White acetylene light automatically occulted at short intervals.

Elevation.—22 feet.

Visibility.—5 miles in the line of range.

Structure.—Pile dolphin supporting a white, wooden, slatwork daymark and platform carrying tank and lantern.

Remarks.—The light is unwatched.

Sailing Directions.—The lights in one, bearing 99° (N. 74° E. mag.) lead up the river from the intersection of their alignment with that of the Garry point range lights to the intersection of their alignment with that of the Deas Island range lights.

DEAS ISLAND RANGE LIGHTS.

Front light.

Position.—On the north side of Deas Island, 400 feet southwest of Cannery wharf.

Character.—White acetylene light, automatically occulted at short intervals.

Elevation.—12 feet.

Visibility.—4 miles in the line of range.

Structure.—Pile dolphin supporting a white, wooden, slatwork daymark and platform carrying tank and lantern.

Remarks.—The light is unwatched.

Back light.

Position.—325 feet 67° (N. 42° E. mag.) from front light.

Character.—White acetylene light, automatically occulted at short intervals.

Elevation.—22 feet.

Visibility.—5 miles in the line of range.

Structure.—Pile dolphin supporting a white, wooden, slatwork daymark and platform carrying tank and lantern.

Remarks.—The light is unwatched.

Sailing directions.—The lights in one, bearing 67° (N. 42° E. mag.) lead up from the intersection of their alignment with that of the Woodward's Island range lights to a point where the front light of the Tilbury Island, showing white, is visible. If this point is overrun, Tilbury Island front light will show red and covers shoal ground.

TILBURY ISLAND RANGE LIGHTS.

Front light.

Position.—On the north bank of the Fraser River, opposite Tilbury Island.

Character.—White acetylene light, automatically occulted at short intervals, with a red sector between the bearings of 38° (N. 13° E. mag.) to 268° (S. 63° W. mag.)

Elevation.—12 feet.

Visibility.—4 miles in the line of range.

Structure.—Pile dolphin supporting a white, wooden, slatwork daymark and platform carrying tank and lantern.

Remarks.—The light is unwatched.

The red sector covers shoal ground from Cottonwood point, Tilbury Island to the southern end of Deas Island.

Back light.

Position.—325 feet 255° (S. 50° W. mag.) from front light.

Character.—White acetylene light, automatically occulted at short intervals.

Elevation.—22 feet.

Visibility.—4 miles in the line of range.

Structure.—Pile dolphin supporting a white, wooden, slatwork daymark and platform carrying tank and lantern.

Remarks.—The light is unwatched.

Sailing directions.—The lights in one astern, bearing 255° (S. 50° W. mag.) lead up from the turn in the channel at Tilbury Island front light to the intersection of their alignment with that of the Annacis Island range lights.

ANNACIS ISLAND RANGE LIGHTS.

Front light.

Position.—On south bank of Fraser River, close to St. Mungo cannery, opposite Annacis Island.

Character.—Fixed red light shown from a 31-day Wigham lamp.

Elevation.—12 feet.

Visibility.—3 miles in the line of range.

Structure.—Wooden platform supported on piles, carrying a square wooden house surmounted by the lamp.

Remarks.—The light is unwatched.

Back light.

Position.—325 feet 90° (N. 65° E. mag.) from front light.

Elevation.—22 feet.

Visibility.—3 miles in the line of range.

Structure.—Wooden open frame work tower supporting the lamp.

Remarks.—The light is unwatched.

Sailing directions.—The lights in one, bearing 90° (N. 65° E. mag.) lead up the river from the intersection of their alignment with that of the Tilbury Island range lights to a point about 3¼ miles below the City of New Westminster.

Variation in 1920.—25° E.

Authority.—Report from Agent Department of Marine, Victoria.

Admiralty charts.—Nos. 1922, 579 and 2689.

Publication.—British Columbia Pilot, Part 1, 1913, page 282.

Canadian List of Lights and Fog Signals, 1920.—Nos. 2313.1 to 2313.75.

Departmental File.—No. 22310R.

A. JOHNSON,

Deputy Minister.

Department of Marine and Fisheries, Ottawa, Canada, 14th May, 1920

No. 28 of 1920.

(Pacific No. 7)

BRITISH COLUMBIA

(66) Strait of Georgia—Fraser River—Buoys Established.

Buoys established.—Three red conical buoys have been established to mark the south side of the new dredged channel north of Westham Islands, which leads into the new main channel north of Brush Islands, of the Woodward group.

Sailing directions.—Mariners proceeding up the river will, after passing black can buoy No. 25, head 99° (N. 74° E. mag.) on the alignment of the Woodward range, leaving the three conical buoys on the starboard hand.

The dredged cut marked by the above mentioned buoys is approximately 5,000 feet long and is 300 feet wide in the centre, widening to 500 feet at each end.

N. to M. No. 28 (66) 17-5-20.

Variation in 1920.—25° E.

Authority.—Report from Agent, Department of Marine, Victoria.

Admiralty charts.—Nos. 1922, 579 and 2689.

Publication.—British Columbia Pilot, Vol. 1, 1913, pages 282-284.

Pacific List of Buoys and Beacons.—Nos. 369.1, 369.2 and 369.3.

Department File.—No. 19376.

No. 29 of 1920.

(Inland No. 10)

ONTARIO

(68) Lake Superior—Thunder Bay—Port Arthur Harbour—Change in Colour of Main Entrance Light.

Date.—On or about 1st June, 1920.

Position.—On cribwork block, 31 feet from south end of northerly breakwater.

Latitude N. 48° 25′ 43″ Longitude W. 89° 12′ 37″.

Change in colour of light.—The occulting white will be changed to an occulting red light.

Authority.—Departmental records.

Canadian Naval charts.—Nos. 114 and 101.

Publication.—U.S. Lake Survey Bulletin No. 28, page 110.

Canadian List of Lights and Fog Signals, 1920.—No. 2199.

Departmental File.—No. 22199A.

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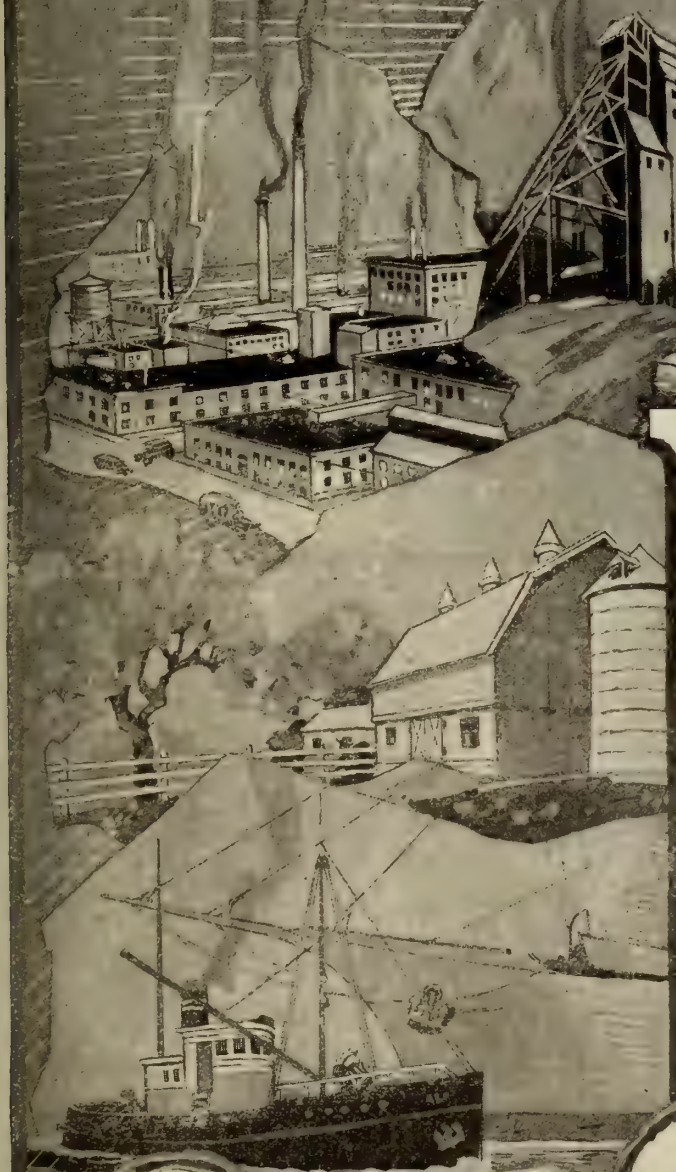

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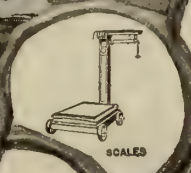

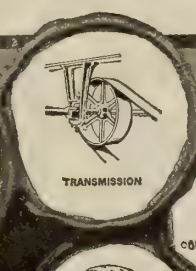

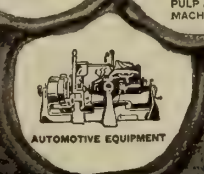

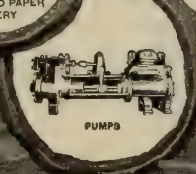

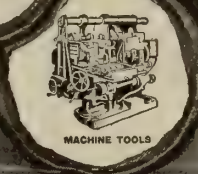

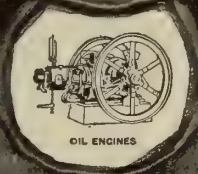

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PRINCE EDWARD ISLAND

(75) North Coast—North Rustico Harbor—Bell Buoy Established

Position.—Off entrance to harbor 1½ miles 246° (W. mag.) from North Rustico main light. Latitude N. 46° 28′ 30″. Longitude W. 63° 15′ 30″.

Description.—Steel cylindrical.

Color.—Red, with "Rustica" in white letters.

Depth.—33 feet.

Variation in 1920.—24° W.

Authority.—Report from agent, Department of Marine, Charlottetown.

Admiralty charts.—Nos. 2034, 1651, 2516 and 2666.

Publication.—St. Lawrence Pilot, Vol. 2, 1916, page 183.

Canadian List of Lights and Fog Signals, 1920.—To be inserted as No. 768-5.

Departmental File.—No. 48572.

NEW BRUNSWICK

(76) North Coast — Northumberland Strait—Richibucto Cape—Ranage Lights Established

Date.—Without further notice.

Front light.

Position.—On beach on north side of breakwater. Latitude N. 46° 40′ 15″. Longitude W. 64° 42′ 40″.

Character.—Fixed white light.

Order.—7th order dioptric.

Elevation.—25 feet.

Visibility.—5 miles from all points of approach by water.

Description.—Pole, with white shed at base.

Height.—25 feet.

Back light.

Position.—On top of bank, 115 feet 291° 45′ (N. 45° W. mag.) from front light.

Character.—Fixed white light.

Order.—7th order dioptric.

Elevation.—36 feet.

Visibility.—7 miles from all points of approach by water.

Description.—Pole, with white shed at base.

Height.—19 feet.

Remarks.—Lights in line lead boats of shallow draft into shelter behind the breakwaters. Local knowledge is required to enter this harbor.

Variation in 1920.—23° 15″ W.

Authority.—Report from Superintendent of Lights, Charlottetown.

Admiralty Charts.—Nos. 2034, 1651 and 2516.

Publication.—St. Lawrence Pilot, Vol. 2, 1916, page 238.

Canadian List of Lights and Fog Signals, 1920.—To be inserted as Nos. 842.2 and 842.3.

Departmental File.—No. 20842.2-3C.

QUEBEC

(51) River St. Lawrence—North Channel—Foot of Orleans Island—Buoys Placed Temporarily for Dredging Purposes

Four steel, can buoys, painted black and white, have been placed temporarily for dredging purposes about ½ mile westward of red gas buoy No. 110B. North channel, foot of Orleans Island. These buoys will be moved from time to time to suit the requirements of the dredging. The buoys are not to be used as aids to navigation.

Authority.—Report from agent, Department of Marine, Quebec.

Canadian Naval charts.—Nos. 206.

Admiralty charts.—Nos. 318, 315 and 2516.

Publication.—St. Lawrence Pilot, below Quebec, 1916, page 149.

Departmental File.—No. 17785.

A. JOHNSTON,
Deputy Minister.

Department of Marine and Fisheries,
Ottawa, Canada, 10th May, 1920

No. 20 of 1920
(Atlantic No. 9)

PRINCE EDWARD ISLAND

(50) Northumberland Strait—Port Borden—Change in position of Range Lights

Former notice.—No. 45 (110) of 1917.

New position of front light.—710 feet 313° 30′ (N. 23° 30′ W. mag.) from old position Latitude N. 46° 15′ 5″. Longitude W. 63° 41′ 22″.

New position of back light.—500 feet 44° (N. 67° E. mag.) from front light.

Variation in 1920—23° W.

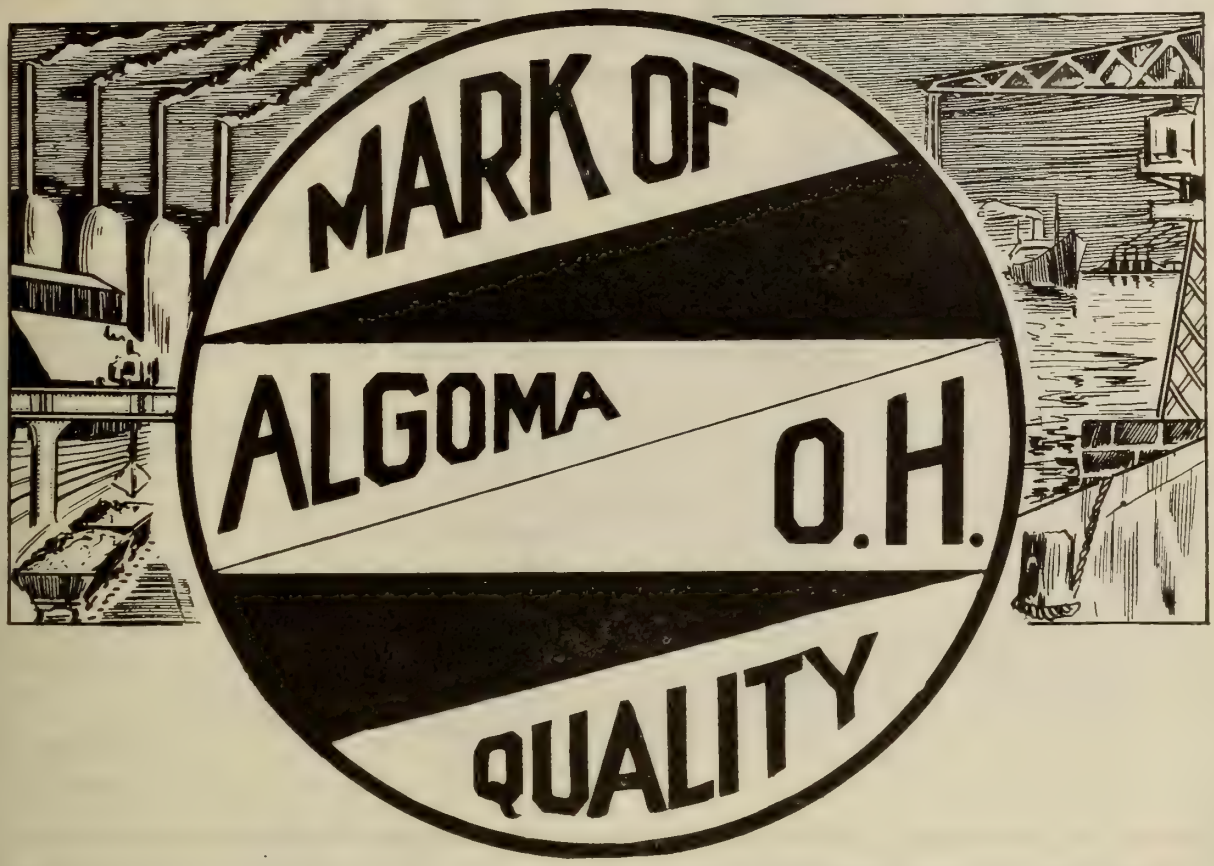
Authority.—Report from Superintendent of Lights, Charlottetown.

Admiralty charts.—Nos. 2034 and 1651.

Publication.—St. Lawrence Pilot, Vol. 2, 1916 page 263.

Canadian List of Lights and Fog Signals, 1920.—Nos. 732 and 733.

Departmental File.—No. 20732-3C.



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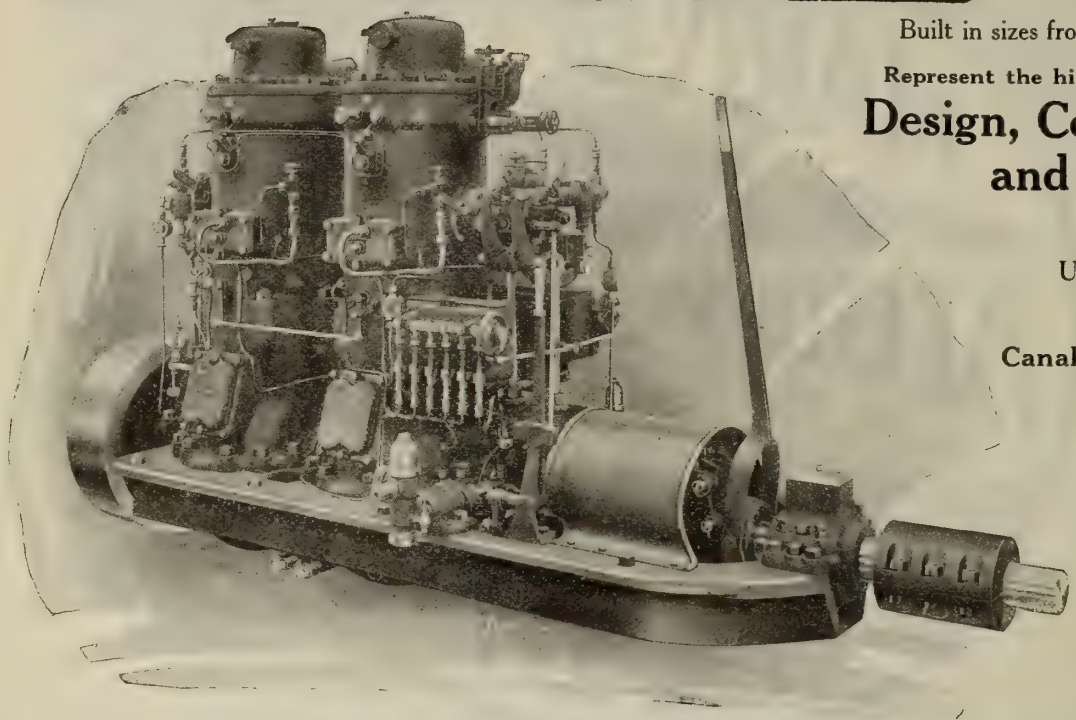

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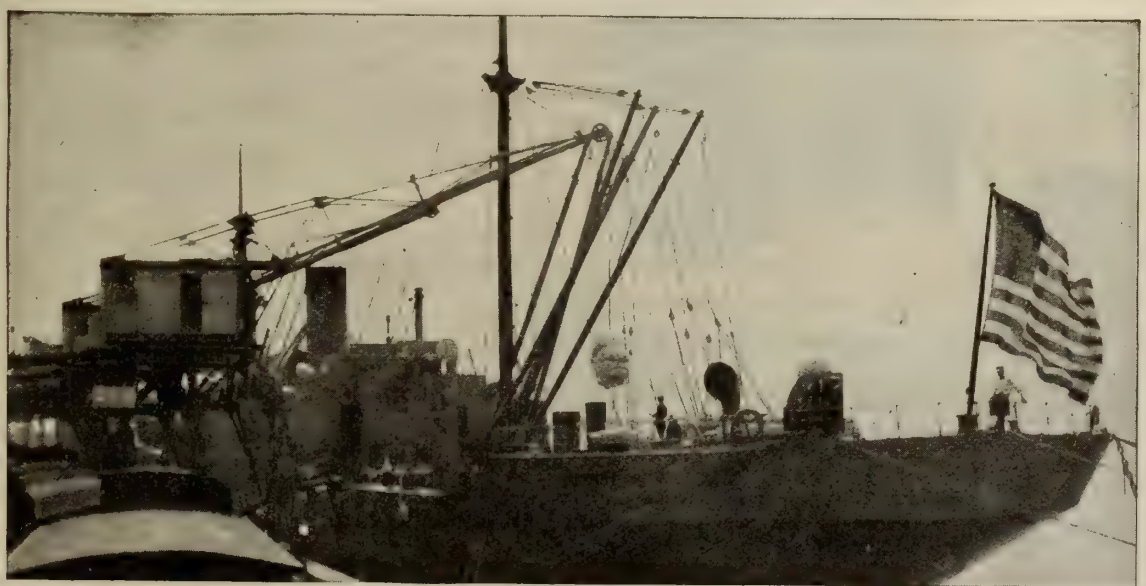

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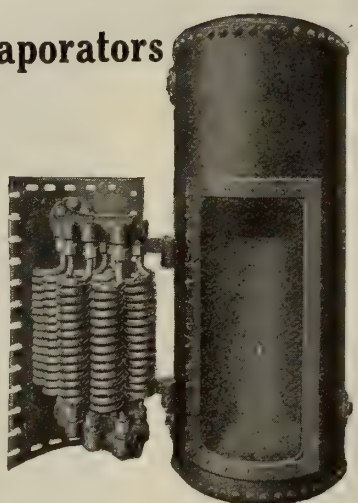

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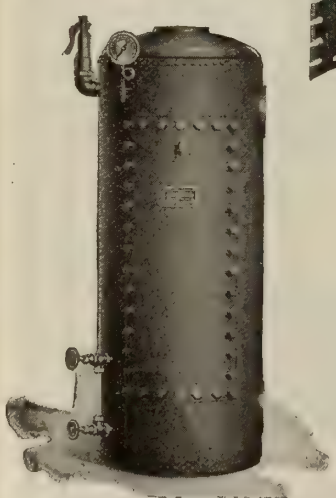

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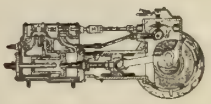

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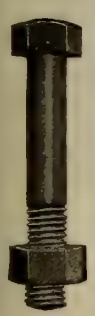

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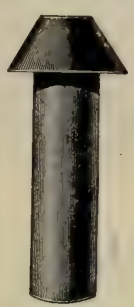

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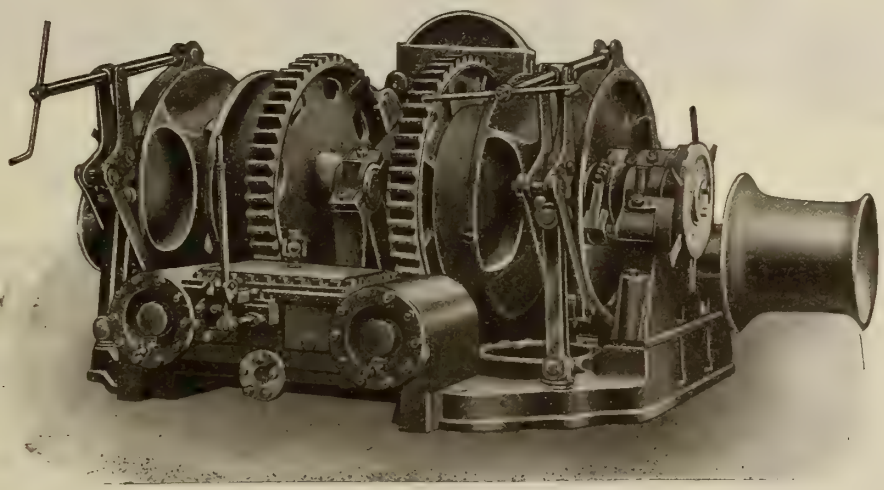

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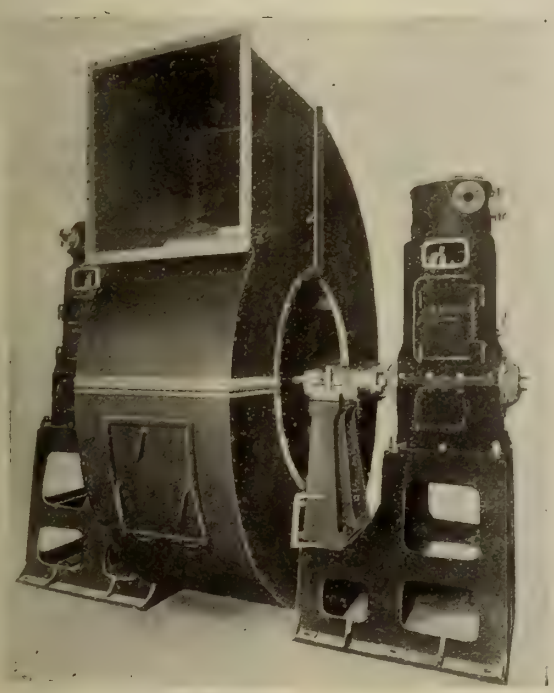

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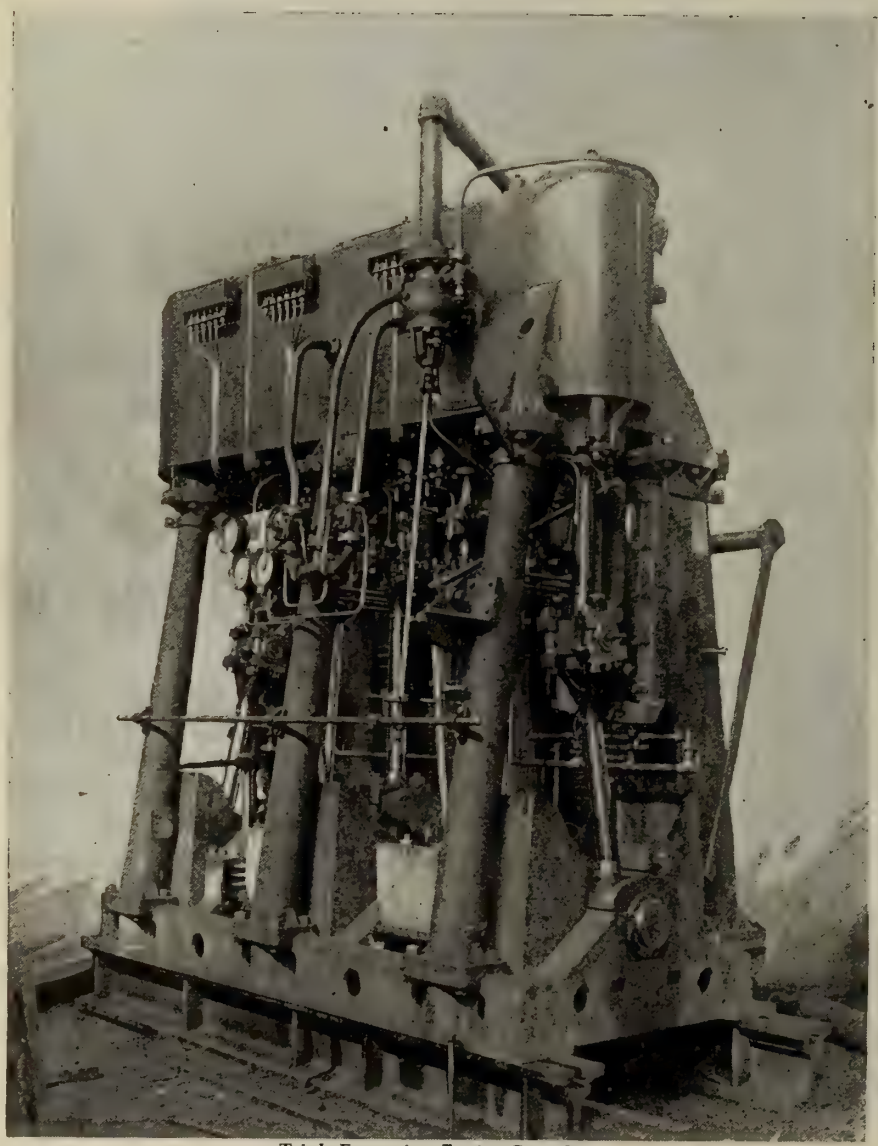

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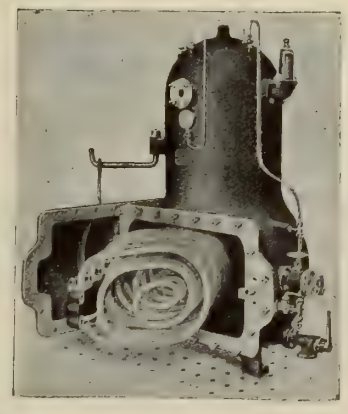

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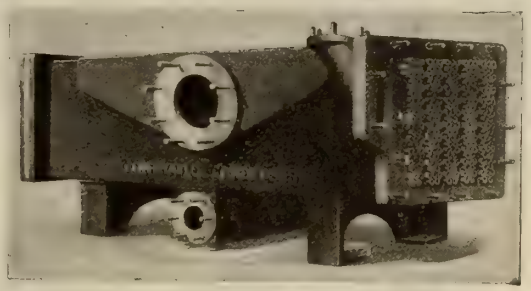

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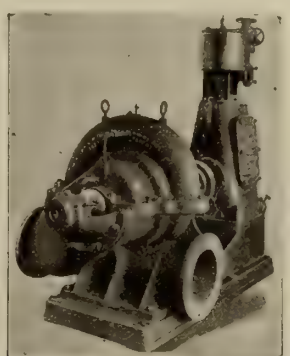

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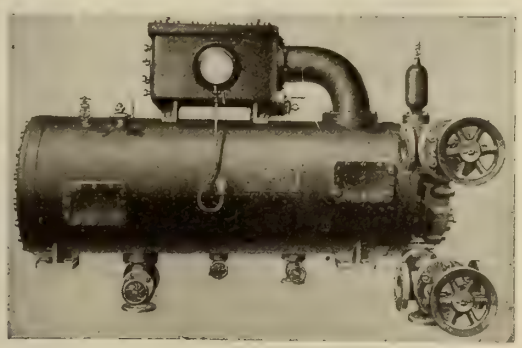

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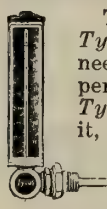

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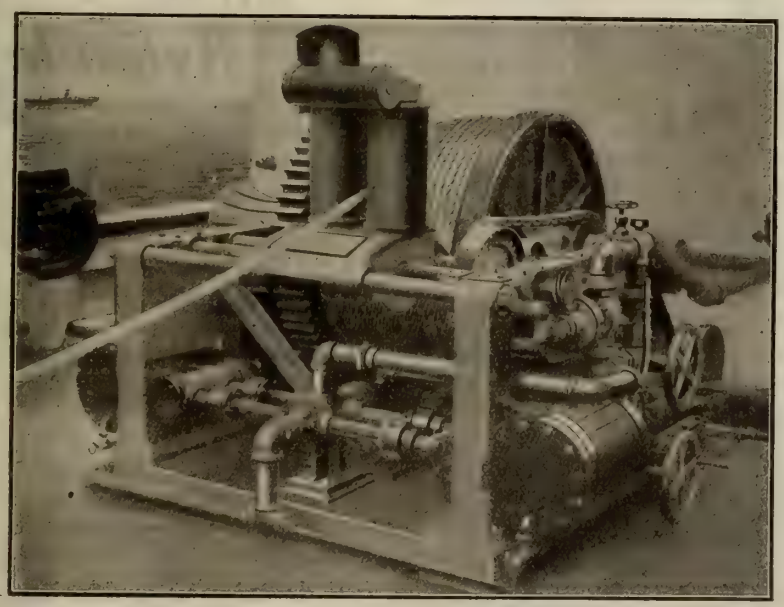

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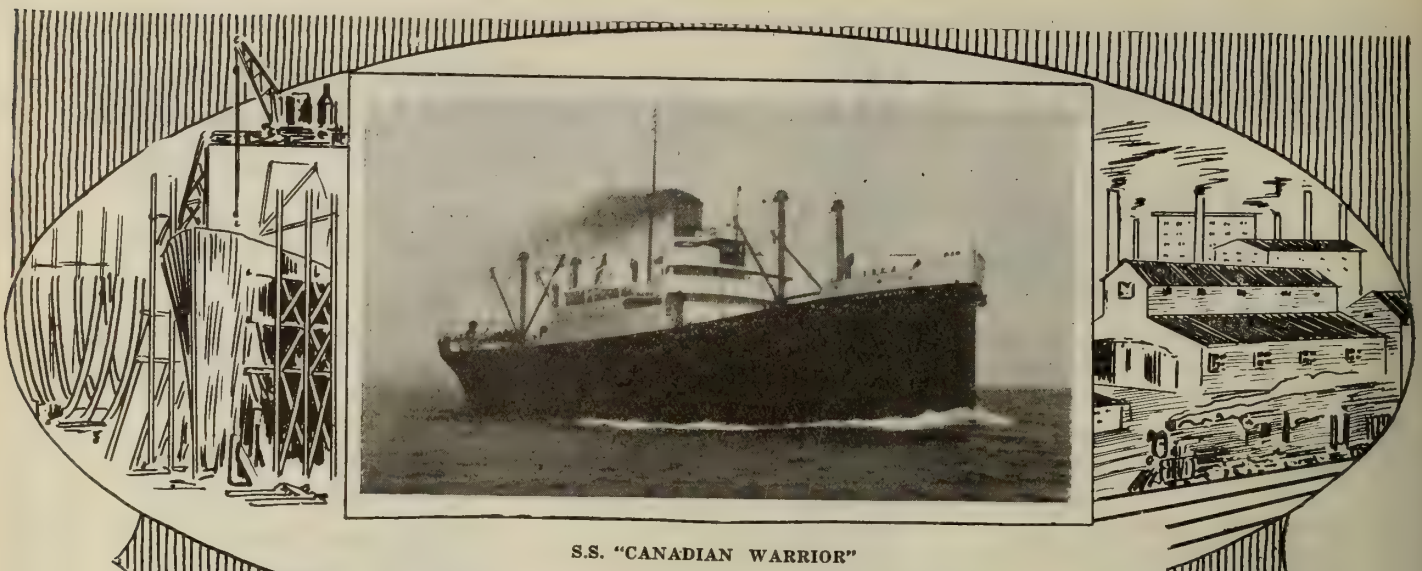
A. R. Williams Machinery Company, St. John, N.B.
A. R. Williams Machinery Company, Halifax, N.S.
H. L. Drullard, Esq., 30 Church Street, New York, N.Y.



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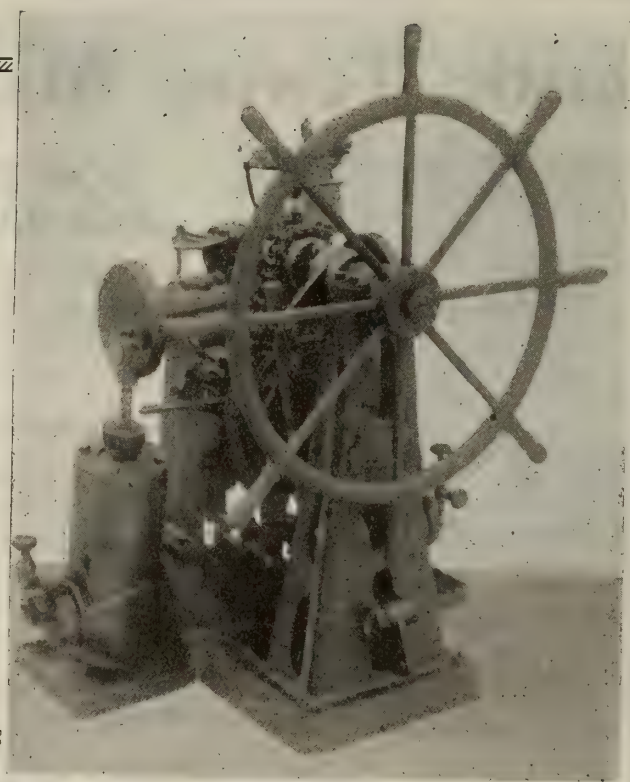

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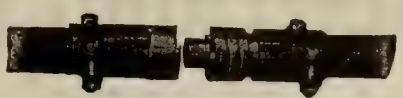
AIR  TIGHT

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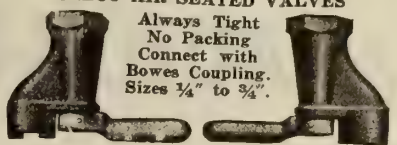

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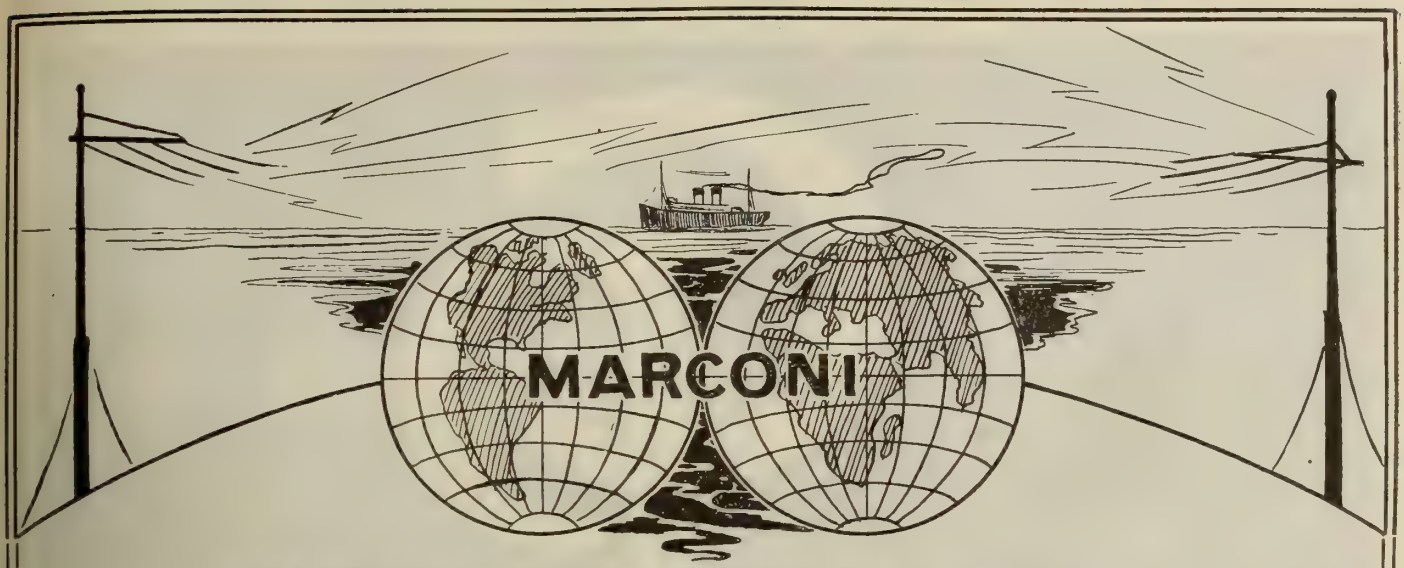

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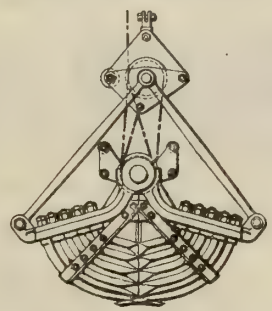

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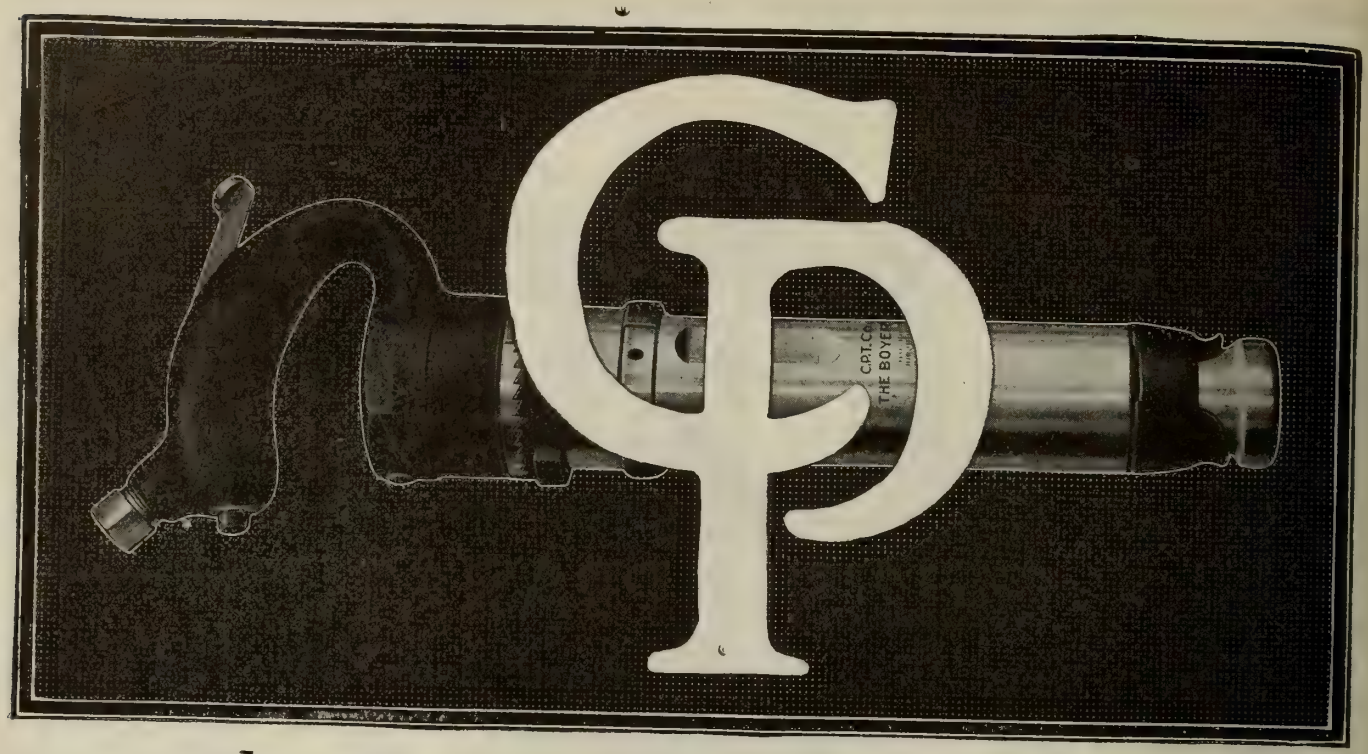

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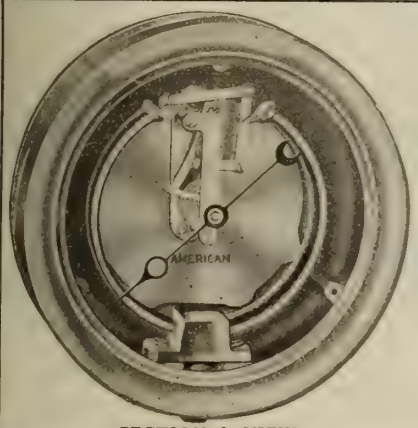

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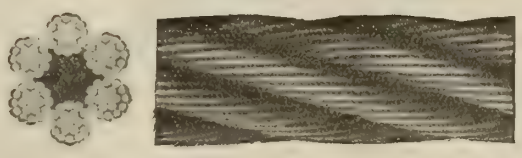

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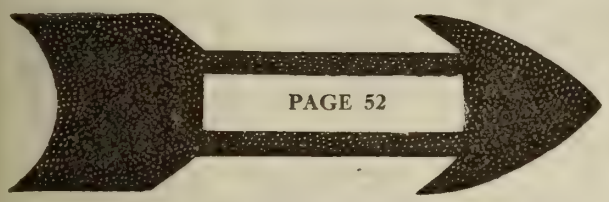

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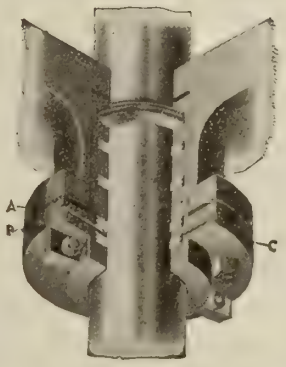

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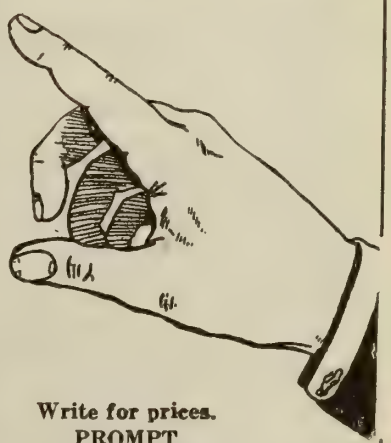

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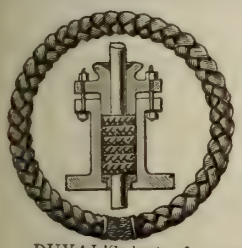

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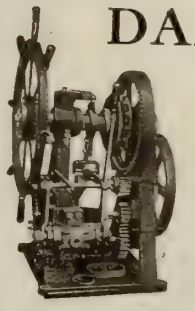

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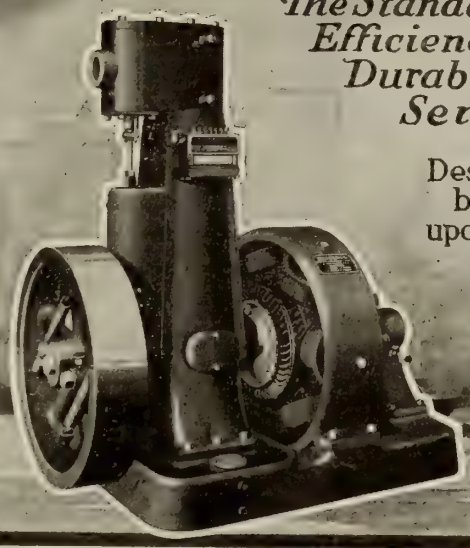

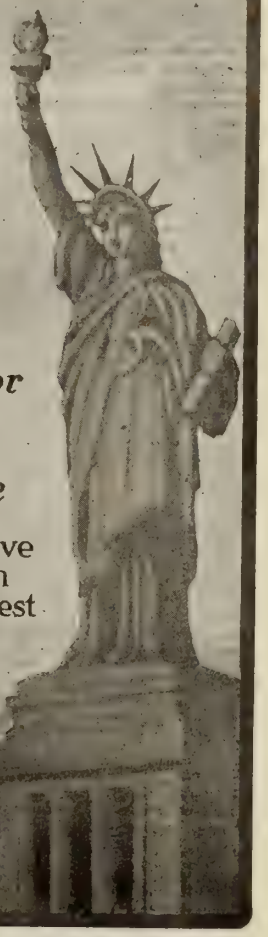

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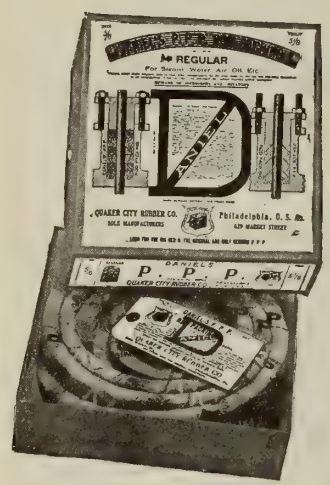

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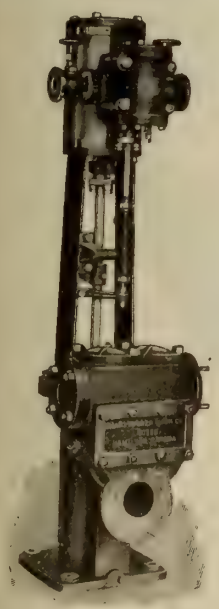

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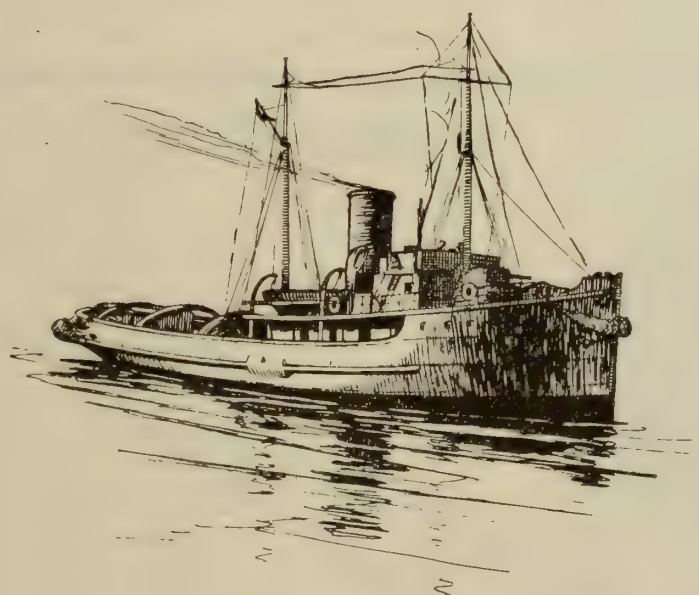

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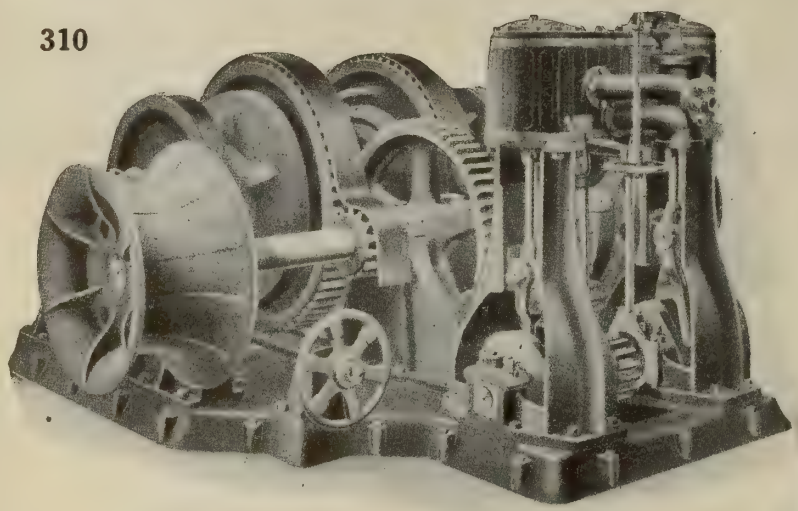

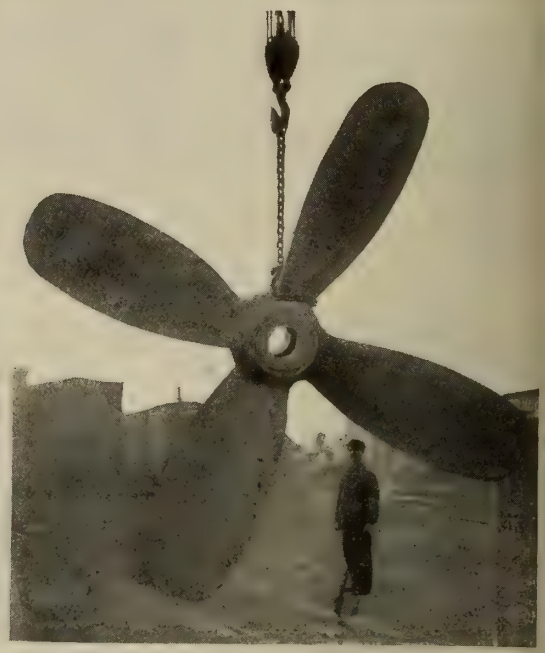

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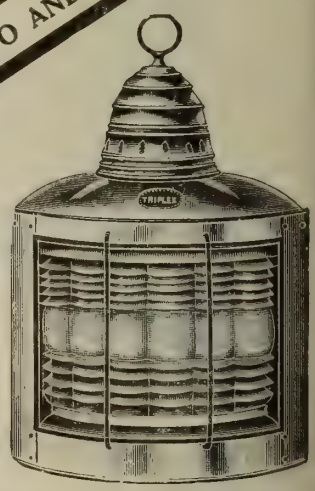

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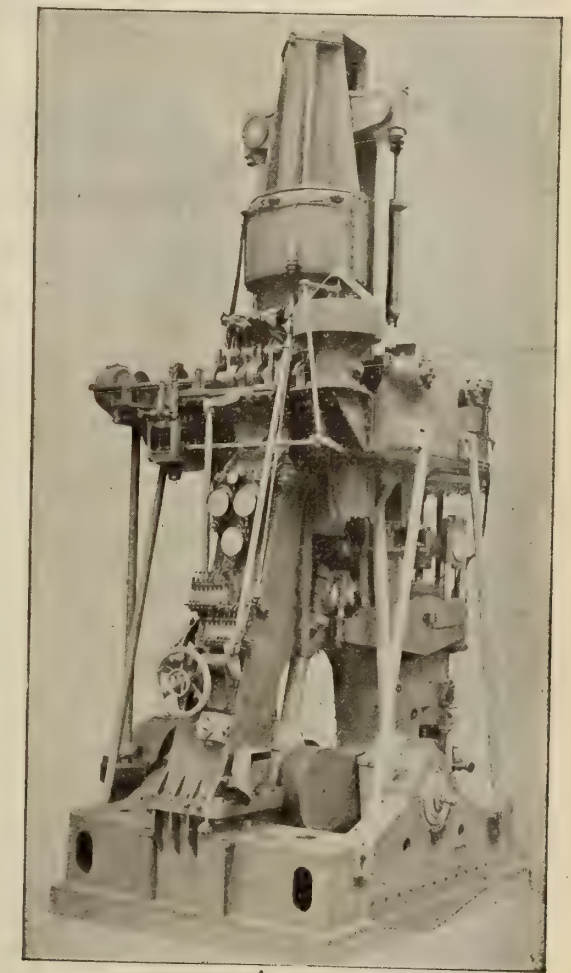

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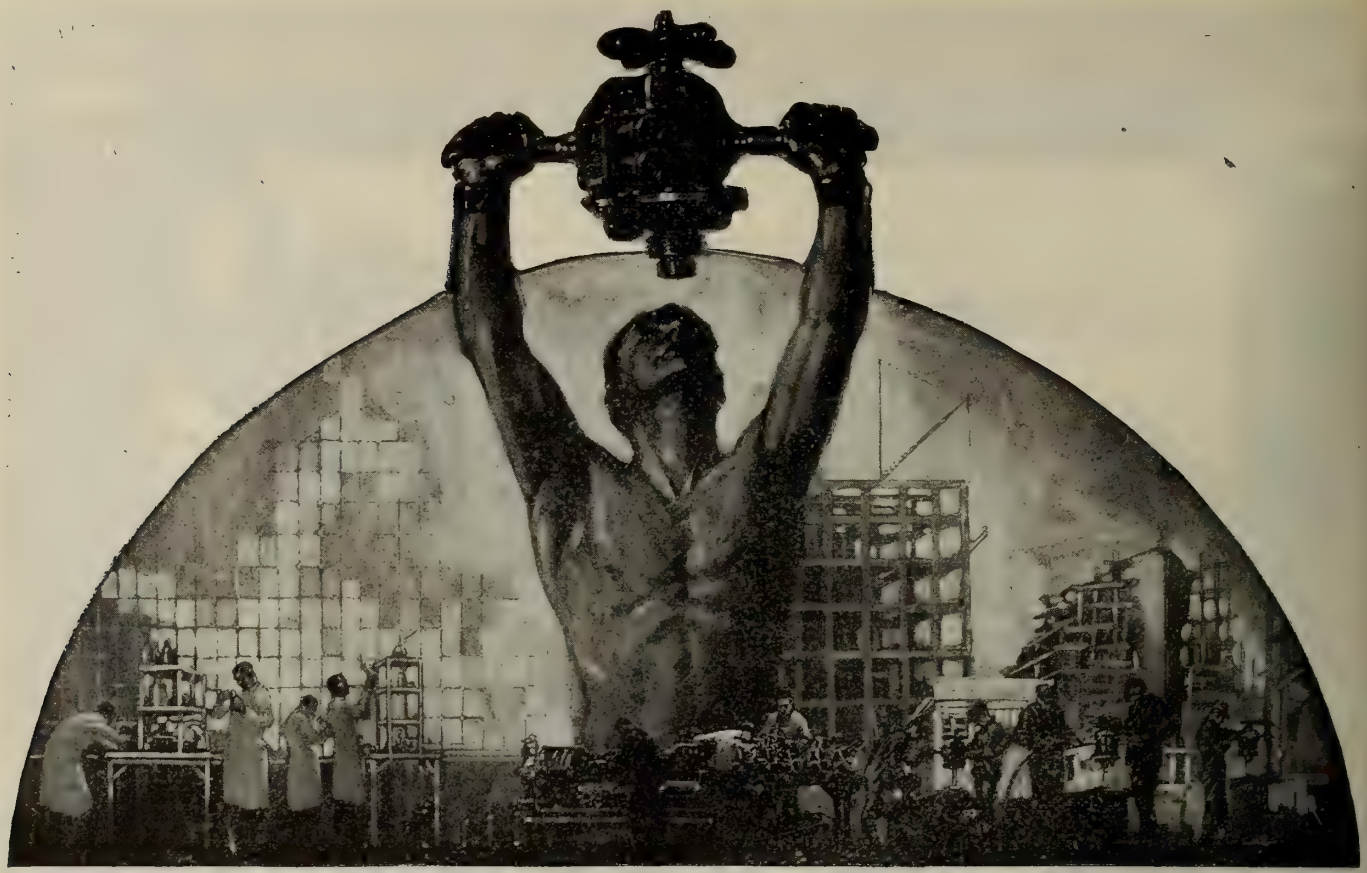

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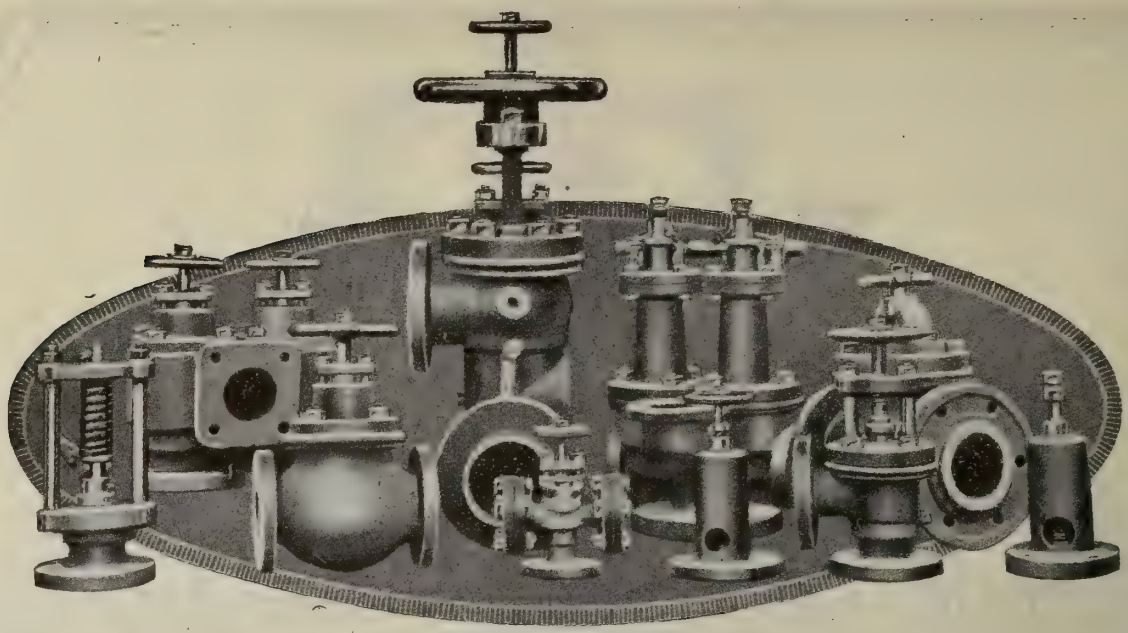

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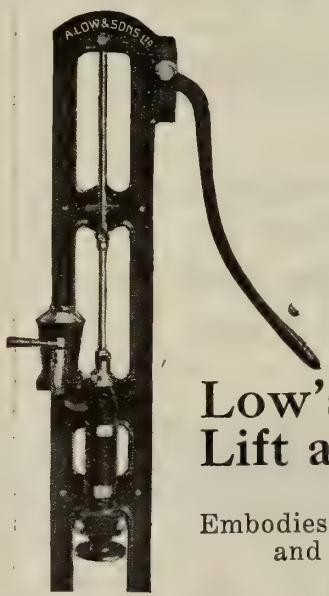

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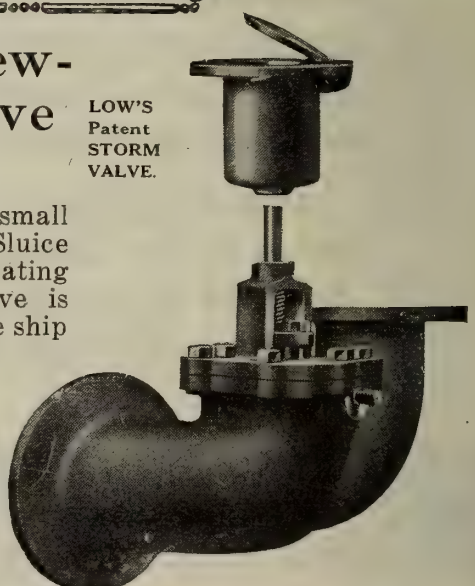

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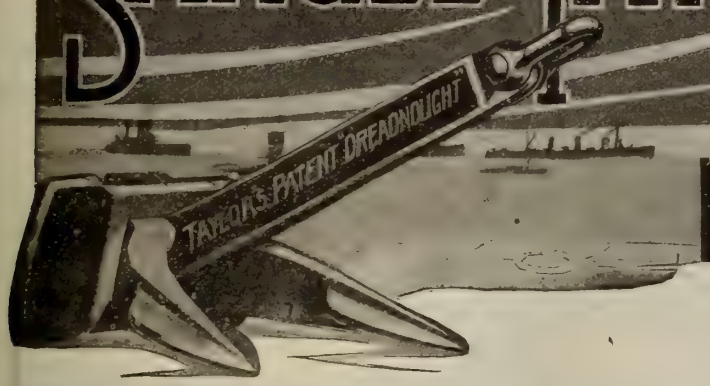

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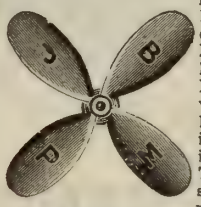

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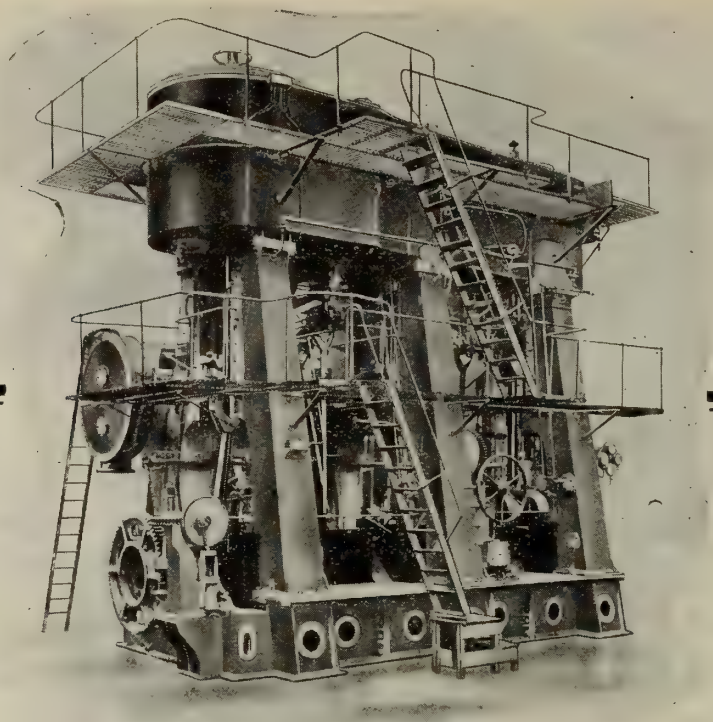

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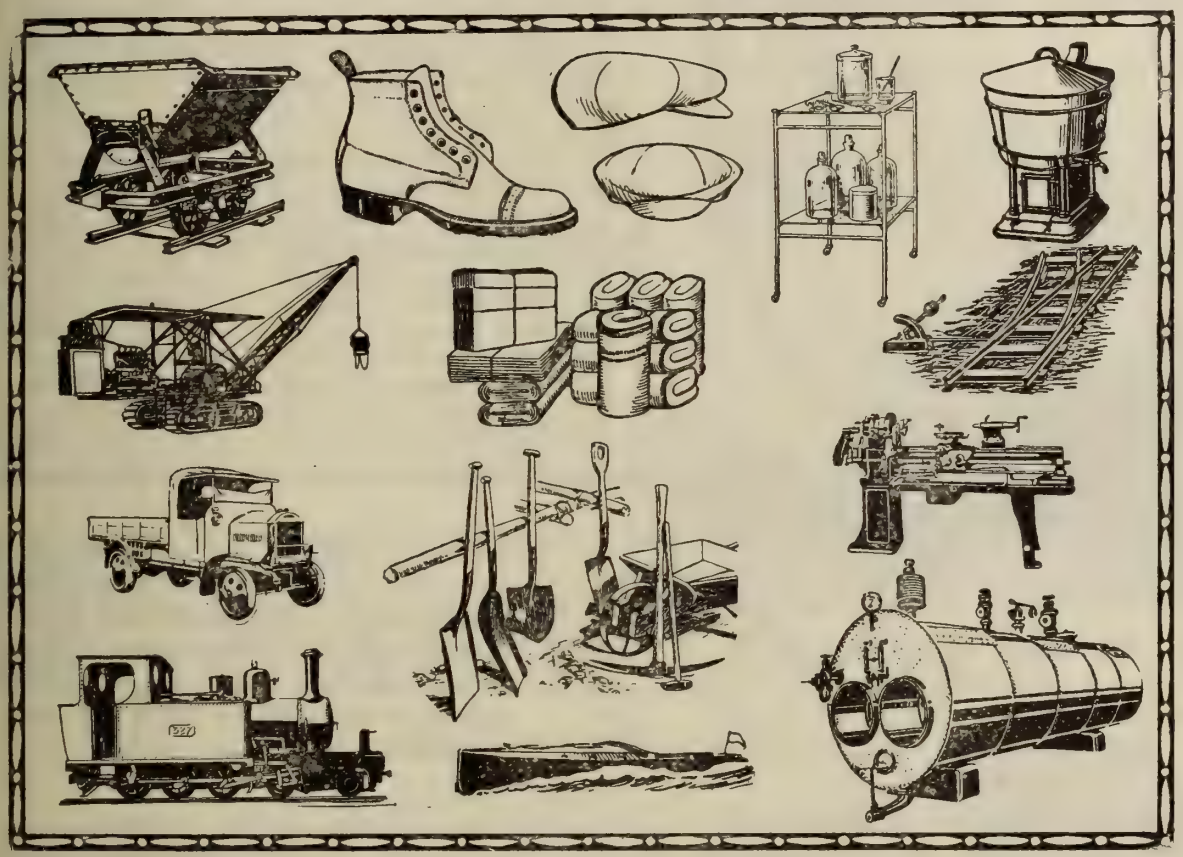

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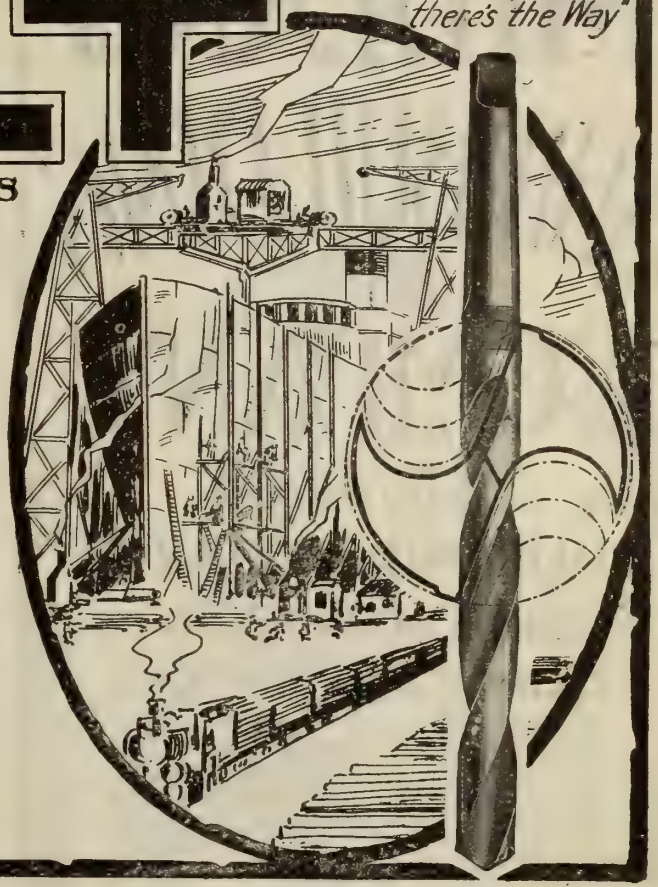

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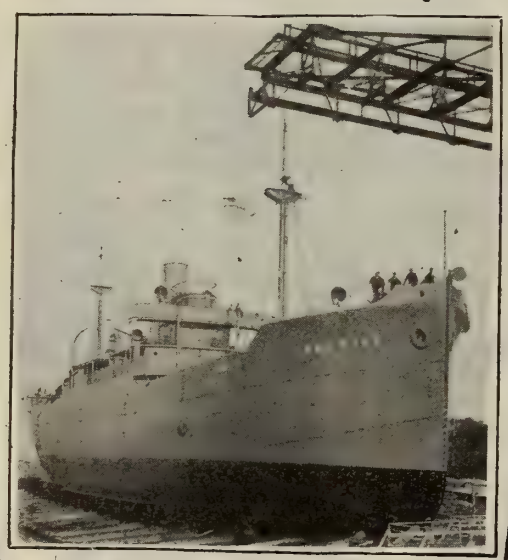

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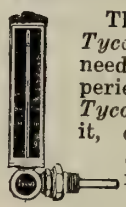

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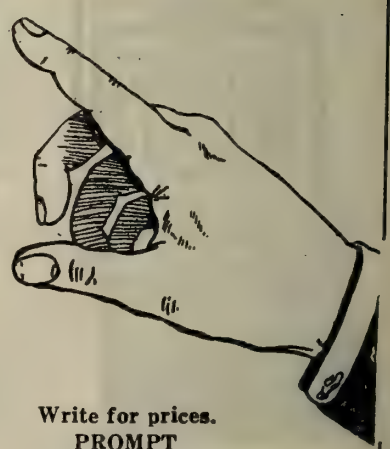

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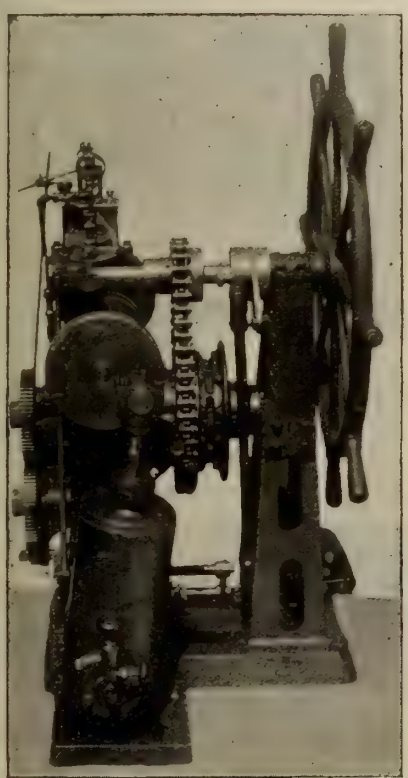

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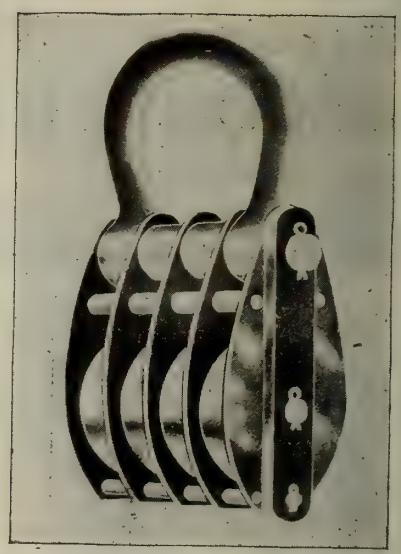

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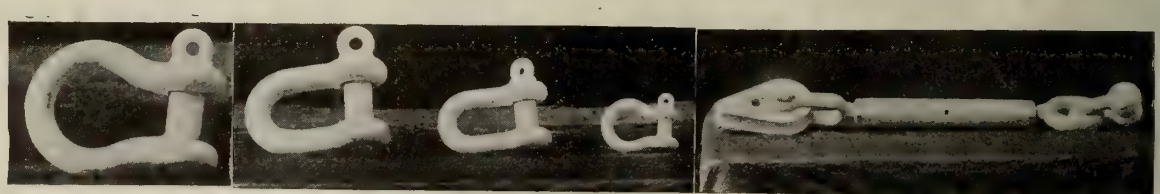

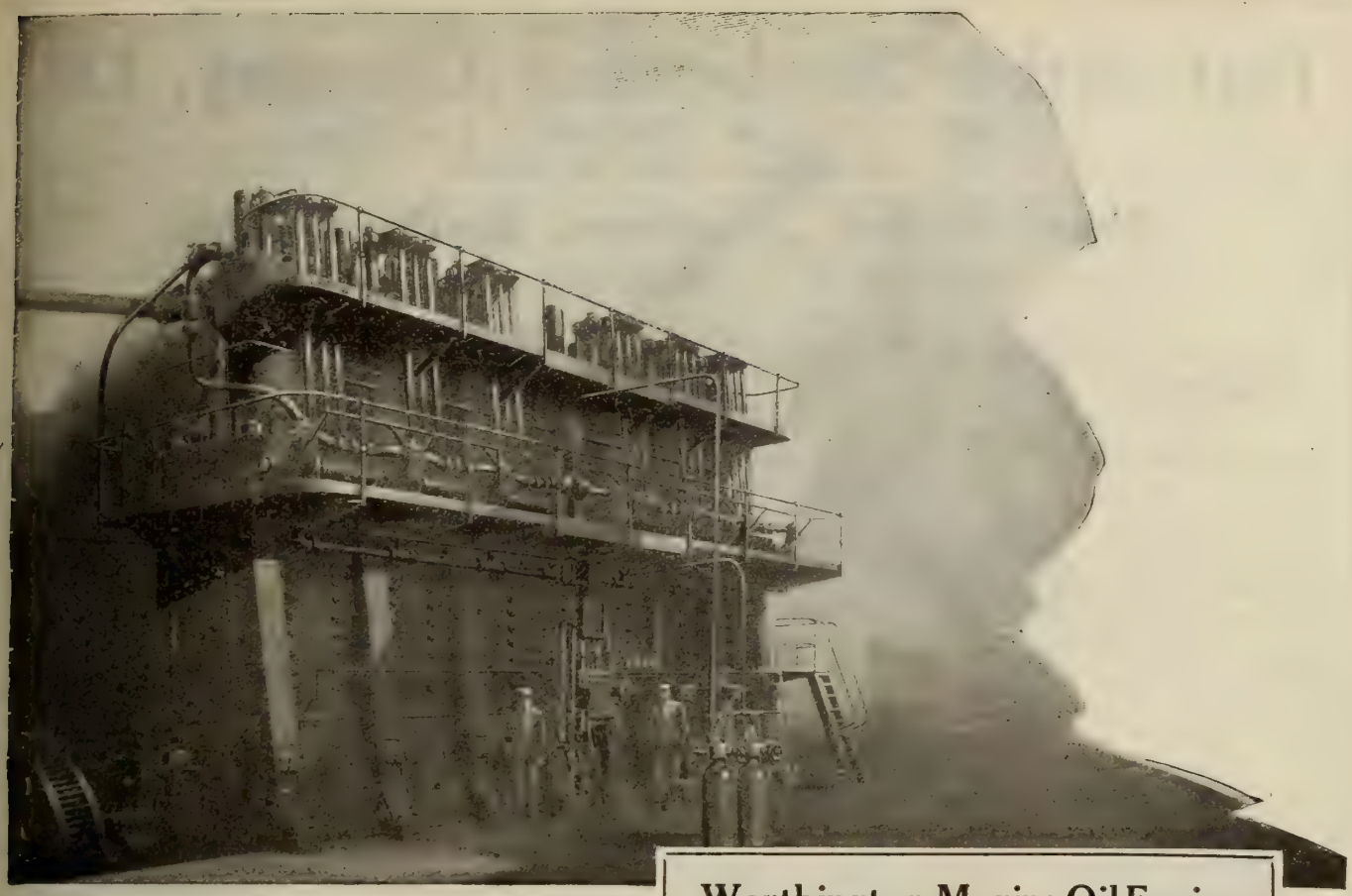

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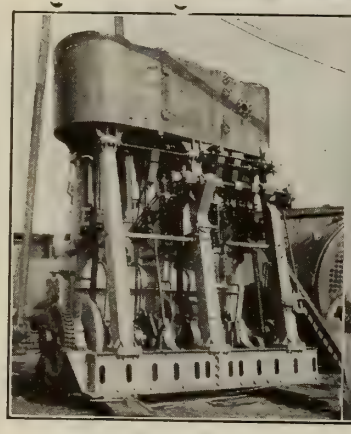

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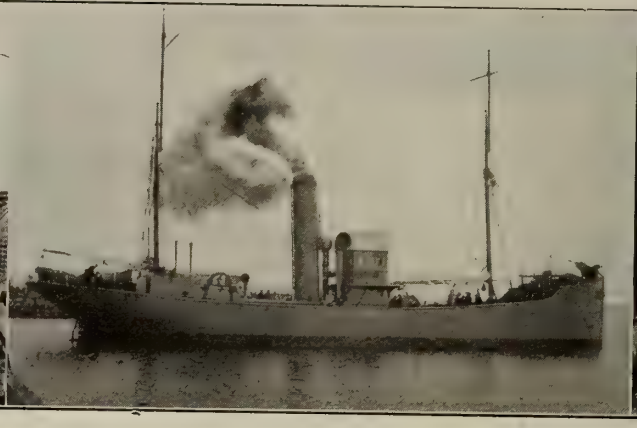

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Vol. X. JULY, 1920 N. 7

Balancing of Turbines and Propellers

A Description of a Machine for the Balancing of Rotors and Experiments Carried Out with It—Paper Read Before the Institute of Naval Architects.

By J. J. KING SALTER, R.C.N.C.

THE author had the honor to present a paper to the members of this Institution in 1917, on the question of the influence of the running balance of propellers on the vibration of ships, in which he advocated their being dynamically balanced. The present paper deals more particularly with the problems involved in determining the position and amount of the weight or weights required to correct the out-of-balance, not only in propellers, but in any class of rotor, and gives the results of tests that have been made to endeavor to take the problem of correcting the out-of-balance from out of the realm of what was really a method of trial and error, into one more nearly approaching exactitude and precision.

In the author's former paper, the method of determining the position and amount of out-of-balance in the particular case of propellers was described, but he was far from satisfied with the methods then in use, and so far as he has been able to ascertain, the literature on this particular phase of balancing is extremely scanty; but as the balancing of rotors is an important matter, it is hoped that the present remarks may be of interest.

It is not proposed to enter into the mathematics of the problems involved in the question of locating the position and amount of the weights required to balance a number of rotating masses; these problems are fully dealt with in text books, more especially those which deal with the balancing of engines, and the conditions for balance are given therein, but in order that what follows may be more clearly understood, the conditions of out-of-balance of a rotor, of whatever form or character, may be shortly stated as follows:

Let Fig. 1 (above) represent a rotor A B mounted on a spindle O X, and assume that this rotor is perfectly homogeneous and in perfect balance, and assume that it is put out of balance by a single weight or weights concentrated, say, at W, at any point along its length A B. This condition constitutes a purely static condition of unbalance.

In Fig. 2 there are two equal weights $W_2 W_3$ at the same distance from the central axis O X, and situated diametrically opposite one another, but at any position along the length A B. This condition constitutes a purely dynamic state of unbalance.

If a rotor loaded, as shown in Fig. 1, was placed on knife edges, this static condition of out-of-balance could be ascertained and corrected by, say, adding a weight or weights W_1 or W_8 at some convenient position or positions along the length A B, but by such balancing on knife edges it will be impossible to know where to so place the weights that no condition of dynamic out-of-balance would not be introduced; on the contrary, it would inevitably happen that in attempting to correct the static unbalance, a state of dynamic unbalance would be introduced.

The rotor of Fig 2, if placed on a knife edge, would show no condition of static unbalance, and its dynamic out-of-balance condition would not be revealed. These two conditions constitute the two elementary conditions of out-of-balance that can be obtained, but in actual practice, either the one or the other by itself will hardly ever occur, but they, of course, might.

Fig. 3 shows the condition that usually occurs, that is a condition that resolves itself virtually into a static and a dynamic out-of-balance combined, where W_4 the weight giving the condition of static unbalance may be, and will almost certainly be at some angle other than that in which W_3 and W_7 lie.

Fig. 4 gives a particular case of condition shown in Fig. 3, where W_4 is at the same angle as one of the weights $W_5 W_6$. This case is mentioned as it will be referred to later.

The problem before us is how in any form of rotor to determine the position and amount of the counter-weights which have to be added or deducted to produce a condition of equilibrium or running balance, the positions and amounts of the out-of-balance masses being, of course, unknown, and remaining unknown, as all that can be done is to counterbalance them by adding or deducting other weights which produce effects equal to, but opposite from, those arising from the unbalanced masses. The author has hitherto heard of no appliance or procedure whereby a rotor can be balanced with any certainty without a slow process of trial and error, but there is one machine* of which the author has heard, and which, the makers state, does determine the amount and position of the dynamic unbalance accurately and rapidly, but the rotor being balanced must be first statically balanced, and the machine has, so far as is known, only been employed for comparatively small rotors, and its application to large ones would entail a very large and expensive machine, and in the opinion of the author, owing to the practically impossible task of first correcting the static unbalance in large rotors weighing ten tons and over, such correction might be far from right, and also, during the making of such correction, as already stated, a state of dynamical unbalance which previously did not exist would most probably be introduced.

The usual method of balancing large rotors on knife edges in the attempt to eliminate static unbalance is, owing to the large inertia of the mass and the friction on the knife edges, a slow and uncertain process, and anything like real accuracy is most doubtful; but in the method to be described, where the rotor is put straight into the balancing machine, no prior notice is taken of any static unbalance, both the condition of static and dynamic unbalance being determined together in one operation. Also, when balancing on knife edges, the only force available is that of gravity, which has to overcome the inertia and the friction on the knife edges, whereas in the rotational method, the centrifugal forces developed are much greater than that due to gravity alone, and of this due advantage is taken.

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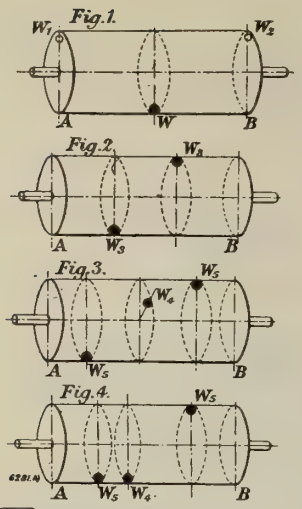
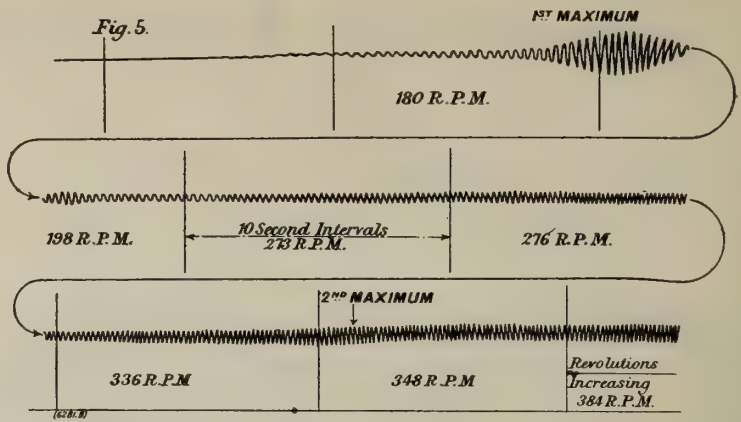
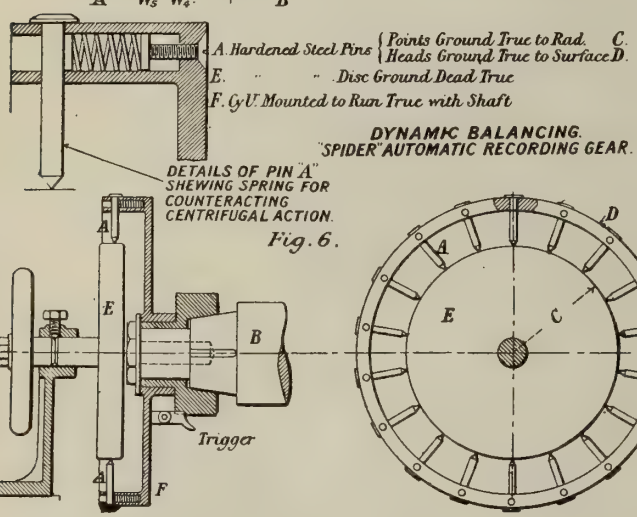
*"Carwen" Balancing Machine. The Carlson-Wenstrom Co., Philadelphia, Pa., U.S.A.






A. Hardened Steel Pins { Points Ground True to Rad. C. Heads Ground True to Surface D.
E. " " Disc Ground Dead True
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DYNAMIC BALANCING.
"SPIDER" AUTOMATIC RECORDING GEAR.
DETAILS OF PIN "A" SHEWING SPRING FOR COUNTERACTING CENTRIFUGAL ACTION.
Fig.6.
Trigger

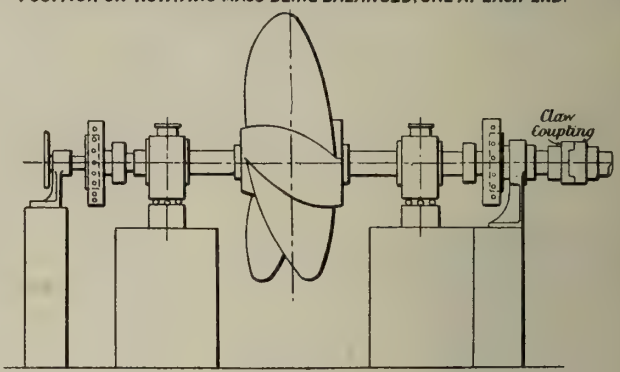


Fig.7. DYNAMIC BALANCING.
DIAGRAMMATIC ARRANGEMENT OF GEAR SHOWING SPIDERS IN POSITION ON ROTATING MASS BEING BALANCED, ONE AT EACH END.
Claw Coupling

FIGS. 1 TO 7—DETAILS OF BALANCING MACHINE.

Bearing these points in mind, the author has been endeavoring to eliminate the ineffective static balancing operation, and to balance whatever unbalance the rotor may have in one operation, as being to his mind the more rational thing to do, and for the reasons given. The rotational method involves mounting the rotor to be balanced in bearings, providing some means of driving it, and some means of allowing it to freely vibrate, such vibration being produced by the unknown forces due to the unknown out-of-balance masses, some means of controlling this vibration and of reading the effects due to these vibrations, and some means of recording the effect produced by the unbalanced masses upon the motion of the whole system.

The type of machine originally used at the Commonwealth Naval Dockyard, Cockatoo Island, Sydney, where the author's tests have been carried out, consisted in mounting the rotor to be tested in bearings, which bearings rested on springs, and the rotor was so controlled that the direction of the vibrations could only take place in a vertical plane, and the rotor was driven by a motor by means of a flexible shaft and a couple of Hooke's joints. The method of operation consisted in rotating the rotor and marking the shaft at both ends with a scriber, as it vibrated, and noting the position of these marks, and then reversing the motion and again marking the shaft, and noting the second position of the marks. It was assumed that the mean position of these marks would indicate the position of the out-of-balance but no relation could be found to exist between the amplitude of vibration and the amount of weight to be added. It may now be stated also that the position given by the markings of the shaft were often nowhere near the final position found for the weights. This method was, to the author's mind, most unsatisfactory.

The reason for marking the shaft first in one direction of rotation and then in the other was due to the fact that the forces causing the vibration moved ahead of the actual vibration, and the mark on the shaft accordingly lagged behind to a varying degree. Now, it was found that the angle of this lag was not constant, but varied very considerably indeed with the speed, and unless the operator happened to mark the shaft at the same speed both ahead and astern, this mean position would be a long way adrift. It was also found that as the speed of rotation increased, the amplitude of the vibrations increased to a certain maximum, and as the speed further increased, the amplitude decreased, and at a still higher speed again increased till it reached a second maximum, which was, however, considerably less than the first; and that no matter how much higher the speed was increased, the amplitude of the first maximum was never again attained. This is illustrated in Fig 5. A little consideration will show that this was due to the springs. In the type of machine under consideration, the springs had to be strong enough to support the weight of the rotor, its bearings, etc., and beyond making the springs longer or shorter, it was not possible to alter them.

As the rotor with its unbalanced masses producing centrifugal forces and moments is rotated, and as the speed increases, the period of the impulses, produced by the unbalanced masses at each revolution begins to coincide with the natural vibrations of the spring, and tends to cause the whole mass to vibrate. The natural vibrations of the spring must of necessity first be faster than the speed of rotation which would cause impulses, and synchronization between the revolutions and the time of vibration of the springs would not occur until a certain speed is reached, which would then cause the rotor on its springs to obtain a maximum amplitude of vibration. It is evident, therefore, that at only that one speed would there be that coincidence, and whilst at the higher speed of the second maximum there would be partial coincidence between the natural vibration of the spring and the speed of rotation, yet at

that speed the amplitude of vibration of the spring must be smaller than the first maximum due to the want of coincidence between the impulses and the period of the natural vibrations. Evidently, therefore, the period of maximum amplitude must be the period of greatest sensitiveness. Such being the case, the conclusion has been come to that if the rotor can be balanced, so as to give no vibration at the first period of maximum vibrations, no better results will be obtained by testing it at higher speeds. In practice, this has been found to be the case, as in all rotors balanced by this method and which have had to work at much higher speeds, no vibration has been detected at those higher speeds.

In particular the case of some blast-furnace blowers weighing about two tons, which were balanced at about 180 r.p.m. to 200 r.p.m., may be quoted. After being balanced they were found to run in as good balance at the speed of 4,000 r.p.m. as at 200 r.p.m. In this statement no account is taken of whipping and whirling actions, as the author maintains that if the rotor be correctly designed to resist any whirling strains, as it evidently was in the case quoted, the balance effected at the low speed must be permanent at any higher speed, except that possibly small differences of density not made apparent at the low speed may become evident at extremely high speeds—at any rate, in those cases of which the author has had experience the statement has held good even up to 4,000 r.p.m.

It is evident that as in the rotational method of balance the centrifugal forces are taken advantage of to produce vibration, the higher the speed at which the first maximum vibration can be obtained, presumably the more sensitive must the test be. Accordingly, in a particular case, in order to decrease the period of vibration of the springs and so get a higher speed of vibration, shorter springs were utilized, but as might have been realized, although the period, at which the maximum vibration occurred, was at a higher speed, yet the amplitude of vibration was considerably less. With the old methods this was unsatisfactory, but with the instrument to be described this is immaterial.

With a given set of springs and a given rotor and conditions of out-of-balance, the period of maximum vibration will necessarily occur at the same speed whether the rotor was driving clockwise or anti-clockwise, as, so far, it has been found that the fan action of rotors or propellers does not appear to have any effect; and as already stated, owing to the variation of the angle of lag, it appeared that the right moment to mark the shaft was just at the moment of maximum amplitude. To do this by hand with a scriber was practically impossible, as moreover it has been found that the angle of lag varies very rapidly, just before and just after that period of maximum vibration, hence some appliance was necessary that would automatically record the angular position of the shaft during its rotation at that moment.

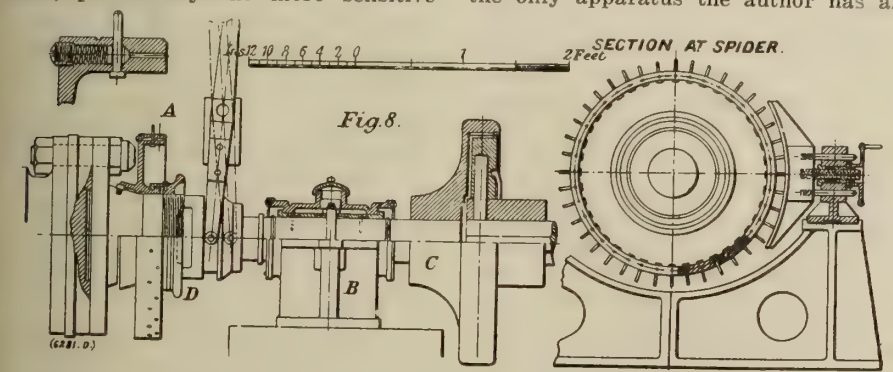
It was also found by the scriber method that, under certain conditions of unbalance, the position at which the maximum amplitude of vibration occurred was not the same at either end of the rotor being tested. It appeared, therefore, necessary to be able to read these positions at both ends. This conclusion has been found correct, as will be shown later.

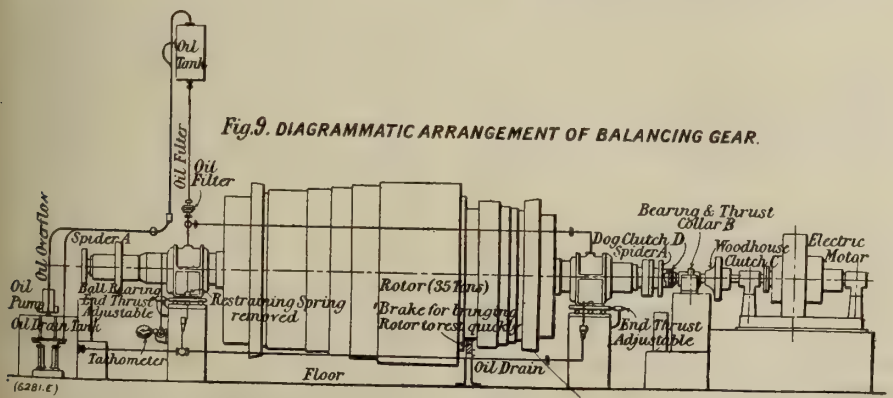
Attention is drawn to this point as the only apparatus the author has any knowledge of takes readings at one end only.* The authors of the article published in Engineering and Commander Cleary both use the same method of ascertaining the angle of lag, which consists of passing a beam of light through a disc secured to one end of the rotating shaft, in which disc is an involute slot; combined with this disc is a mirror which is caused to oscillate in conjunction with the vibrations of the rotor. A spot of light by these means is made to move across a screen in a straight line when there is no vibration, and in a wavy form when there is, and by noting the position of the waves, the angular position of the vibration is determined.

This method, while it appears to have given the users of it satisfaction, did not give a permanent record and only the motion of one end—which the author hopes to show is not sufficient to properly determine the position and amount of the correcting balance weights, observing that this apparatus only gives the position of where the unbalanced masses appear to be. By this method, also, any static unbalance is dealt with in combination with any dynamic unbalance.

The apparatus to be described was not the first designed. Two other arrangements were tried; one failed owing to being unable to mark a rotating disc sufficiently rapidly or clearly, and the other, which was on the Flashlight Torsionmeter principle, was too slow and cumbersome, and had the same defect as the involute slot indicator in that it gave no permanent record, and a careful record of the speed of rotation had to be obtained—ahead and astern. The readings not being instantaneous, the difficulty was to secure such constancy of speed of revolution that the results would not be affected.

The apparatus which has been adopted and which was devised by the author gives a permanent record of the angle of lag and automatically records the angle of lag at the period of maximum vibration, taking no more time than is required for the rotor to make one revolution at that period. The latest design but one of this appliance is shown in Figs. 6 and 7. Fig. 6 shows the details of the gear and Fig. 7 shows how it is applied to the rotor being balanced. From Fig. 6 it will be seen that it consists of a short cylinder (D) attached to the revolving shaft (B), and through the cylinder pass a number of hard steel pins (A) as shown, which pins are arranged so that they can move outwards radially through the thickness of the cylinder. All the inner points of the pins projecting inwards are ground to exactly the same circle, and all the outer ends of the pins resting against the surface of the cylinder are also ground, so that they are all proud of the cylinder's surface to exactly the same extent. It is most essential that





FIGS. 8 AND 9.

*Vide Engineering, vol. xcix, p. 64, January 15, 1915; also a paper by Commander F. J. Cleary, U.S.N. (Journal of the American Society of Naval Engineers, vol. xxx, February, 1918).

the cylinder, with its pins, which we have called the "spider," shall be exactly true with the revolving shaft, otherwise false readings will be obtained.

A second short hardened steel cylinder or disc (E) ground true to the same diameter as the inner points of the pins is erected on a fixed base in line with the first cylinder.

The second cylinder is made to slide axially, so that it can be pushed in under the pins, or pulled out away from them. The action is as follows: The fixed cylinder is, say, pushed in and lies within and just touching the inner points of the pins on the spider, which is attached to a revolving shaft; clearly when rotation of the shaft is started, if there is no vibration the pins will just rub around the fixed cylinder, and no motion of the pins will take place, but if vibration occurs, the pins in the revolving cylinder at that point in its circumference where the vibration occurs will be pushed out, and pushed out to the extent of the vibration, and with each succeeding increase of vibration, so will the pins be pushed out, and as the position of the vibration relative to the rotor varies, i.e., as the angle of the lag varies, so will the pins be pushed out correspondingly till the period of maximum vibration is reached and passed, when the pins recording that maximum will no longer be affected. The motion may then be stopped, and the distance the pins have been pushed out can be measured, and the position of the highest pin can be located. A slight eccentricity between the setting of the two cylinders is immaterial; if they are not in line, the only result will be that as the spider revolves it will act on all pins equally to the extent of the eccentricity. In the vertical motion type of balancer the centre of the revolving shaft was, owing to the addition or subtraction of weights, constantly altering, necessitating the stationary disc being readjusted to suit. This obviously took time, whereas, with the horizontal gear, to be described later, once the centres are adjusted, they are correct for all time on the one job. Owing to the variation of the angle of lag as the speed alters, it will be found that all the pins are pushed out gradually, increasing from a minimum to the maximum. It will be noted that the spider gives the extent of the half of the total amplitude.

Two of these instruments are used, one at each end of the apparatus being balanced; that at the driven end — having to allow for the driving shaft —is of annular form, so as to surround and be clear of the shaft and give room for it to vibrate.

When the out-of-balance is considerable, the position of the pin that is farthest out can be readily detected by the eye, but when it is small it is necessary to measure the height of the pins with some form of micrometer. A very handy form is a clock micrometer which is quickly read, and gives readings of 1-1,000 of an inch. By the use of this micrometer, the necessary magnification of the actual amplitude of vibration given by the pins is obtained.

This instrument gives not only the angular position relative to the rotor, where the maximum amplitude occurs, but also a measure of the extent of that maximum amplitude of vibration. It does this very simply, very rapidly and automatically, and also takes account of the instant at which the maximum amplitude occurs, without any necessity for an observer to be watching to note when this period occurs.

It is maintained that when the amplitude of vibration is at its maximum is just the moment that is best for a record of it to be obtained, as the spider readings are automatically recorded at the same speed. At other periods than this records can be obtained and can be utilized under certain conditions, but it involves obtaining readings of the spiders at the same speed of rotation ahead and astern.

Fig. 8 shows the latest design. It will be seen that the inner fixed disc has been shifted from the inside of the revolving spider and placed outside, not completely surrounding the pins, but as short arcs, of sufficient length to operate the pins. This arrangement very greatly simplifies the gear at the driven ends. The pins are now pushed inwards instead of outwards, and incidentally it will be noted that the pins pushed in most are on the side towards which the vibration occurs, whereas before they were diametrically opposite, for which a correction had to be made. It will be seen that when the vibrations are small, unless the spider disc is accurately true with the revolving shaft, it will be difficult to determine the true position of the pin with the greatest displacement, and the best way to obtain accurate readings, particularly when the vibrations are very small, is to lock the rotor so that it cannot vibrate, then spin it and adjust the arcs operating the pins so as to push them in a small distance, then take the readings of the pins which when operated upon this will be true to the shaft, and which will give a zero reading for any further tests, when the vibrations are required to be read. It will be noted that as the points of the pins now radiate outwards and the measurements of their displacements are measured on the points and not on the heads, consequently the points only need grinding to a true circle relative to the discs. With these precautions these spiders have been found to give very satisfactory and reliable results.

Having obtained this appliance, a series of tests were made with a balanced rotor, by putting it out of balance with known weights in known positions. Also, at this time, owing to the inconvenience and other disabilities of the balancing machine with a vertical motion, it was decided to adopt a motion of vibration in a horizontal plane by carrying the weight of the rotor, its bearings, etc., on ball races, and controlling the vibrations with side springs, whose size and length could be altered at will. To ensure uniformity of action, all the four springs should be adjusted so as to be the same strength and length.

Figs. 9 to 11 show the latest arrangement of balancing machine on this plan, which has been constructed to balance the rotors of H.M.A.S. Adelaide, which are being manufactured at Cockatoo Island. These rotors each weigh about 35 tons.

One of the first things discovered with the spiders was that the driving gear then used, viz., the flexible shaft with Hooke's joints, caused, when there were any vibrations, serious disturbances, and produced some extraordinary anomalies which entirely upset the spider readings. As no means could be devised to drive the rotor and not disturb the vibrations generated by its out-of-balance forces, a different system had to be adopted. Previously spider readings were taken as the motion was started from rest and the speed increased until the period of maximum vibration was reached; the motion was then stopped and spider readings recorded by the micrometer. The practice now is to drive the rotor through a dog or other suitable clutch and lock the rotor so that it cannot vibrate, whilst the speed is being accelerated to a point beyond that at which the maximum vibration occurs, then declutch and unlock the rotor so that it can vibrate, put the spider into operation and whilst the speed is slowing down by its own friction, obtain a reading of the angle of unbalance at the moment of maximum amplitude whilst the rotor is uninfluenced by any disturbing forces except those due to its own internal out-of-balance masses. This procedure obviously takes longer than the former, but there is no doubt whatever, by the results of the tests, that it is the right and only way. Fig. 12 illustrates the disturbing effect of the driving gear.

It was hoped that the reading of the actual amplitude of vibration and angle of lag given by the spiders would enable a measure of the amount and position of the out-of-balance to be obtained, but the hopes in this direction have not been realized, although the author would not like to state that some solution does not exist, and search had to be made in other directions to obtain the information required.

Firstly as regards the angle of lag, it was found that so long as a condition of unbalance existed as represented by Figs. 1 and 2, the spiders gave the true position of these out-of-balance masses, but when a condition as in Fig. 1 existed with the weight at either the driven or the free end only, and assuming the weight at the free end, the spider reading at that end gave the correct angle, but at the other, the driven end, the angle was practically 180 degrees out, showing the reflect action of the weight at the free end, and vice versa when the weight was shifted from the free end at the driven end. Up to this time both ends were allowed to vibrate together.

Tests with weights, as shown in Fig.

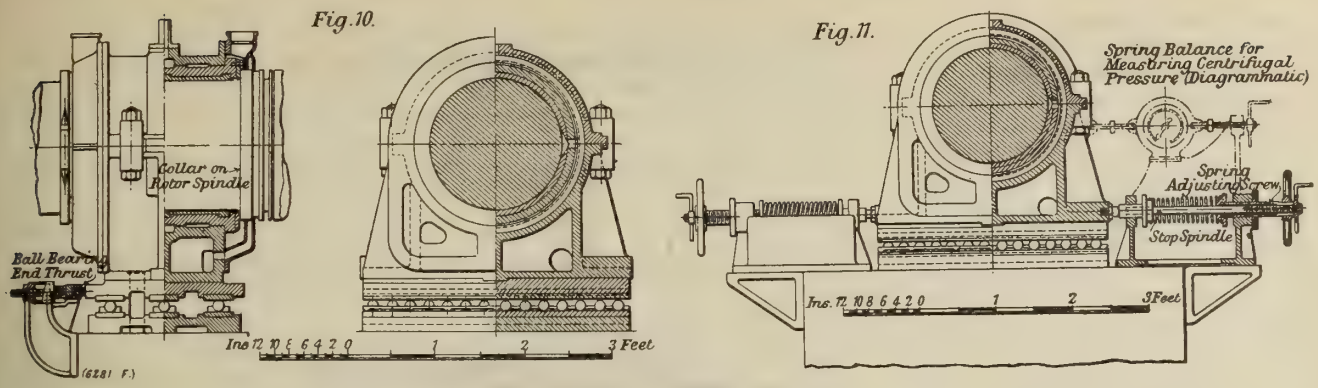


Fig.10.
Collar on Rotor Spindle
Ball Bearing End Thrust
Ins. 12 10 8 6 4 2 0 1 2 3 Feet
(6281 F.)
Fig.11.
Spring Balance for Measuring Centrifugal Pressure (Diagrammatic)
Spring Adjusting Screw
Stop Spindle
Ins. 12 10 8 6 4 2 0 1 2 3 Feet

FIGS. 10 AND 11—OTHER DETAILS.

2 gave correct angles as might be inferred from the former tests, and as the weights were in the same plane but diametrically opposite one another, the reflex action of the weight at one end on the motion at the other end was not at once apparent, but although the position of out-of-balance was in this case accurately given by the spider, in this case also no relation between the amplitudes of vibration at either end and the amount of the unbalance could be found to exist that could be interpreted.

A third series of tests were made, giving a condition that corresponded with Fig. 3. Here the reflex action of the weights was more apparent, and no solution was immediately seen. The next step was to hold one end whilst the other was free to vibrate. This was done first at one end and then at the other, and the spider readings gave angles which on careful analysis were found to be the resultant action of all the unbalanced masses. It then became apparent that if the forces acting on the springs causing vibration could be measured it would be possible, knowing the direction of the resultant forces as given by the spiders to plot vector diagrams and thus obtain the true position and amount of the counterbalance weights.

Consider what forces are in operation. There is the rotor mounted on the bearings, one at each end, with its out-of-balance masses, and when the rotor is rotated, the out-of-balance masses under the centrifugal action produce alternating pressures acting on the bearings which tend to set up vibrations — the resistance offered by each of the bearings clearly balances the centrifugal forces produced. This resistance and the centrifugal forces accordingly constitute a set of forces in equilibrium. If, then, we can measure the resistance the bearing has to offer to balance the centrifugal forces due to the unbalance, we have a measure of these out-of-balance forces. It is proposed to call these forces acting on the bearings the "centrifugal pressure" on the bearing.

The springs located on the balancing machine opposite each bearing should be able to furnish a measure of this centrifugal pressure, but if whilst being rotated the rotor is allowed to vibrate under the control of the springs, so many unknown factors are introduced that it has been found impossible to find the relation that exists between them, but if, whilst the rotor is revolving, the rotor in its bearings is not allowed to vibrate, then a host of complicating elements are eliminated, and it is possible to measure the amount of the centrifugal pressure on the bearings, and this was done as follows: The bearing at one end was fixed so that it could not vibrate, and the bearing at the other end was held by a stop on one side and by a spring on the other (Fig. 13). The strength of the spring was adjusted so that it was greater than the centrifugal pressure operating at any particular given speed, the spring was then gradually eased back as the rotor was spinning till the centrifugal pressure, at the particular given speed, just overbalanced the spring. This speed was noted by an accurate tachometer; the moment at which the spring and the centrifugal pressure balanced, without allowing any perceptible movement of the rotor and its bearing, etc., to take place, was most readily observed by inserting a piece of paper behind the stop on the side opposite the spring and by pulling gently on that paper till it was just free. Directly it was free the easing back of the spring was stopped and the speed at that moment recorded. The amount of the centrifugal pressure being an unknown quantity, the strength of the spring required to balance it at any given speed, had, of course, to be first obtained by trial. The rotor was, of course, allowed to revolve under its own forces as when taking readings of the spider. It was then only necessary to obtain a measure of the strength of the spring at the particular setting. This was most conveniently done by means of an accurate spring balance by hooking it at the bearing and pulling against the spring till the paper behind the stop was just free.

This process was then repeated at the opposite end, thus giving two forces — acting at selected points, viz., the centre of the bearings—which were a measure of the forces necessary to balance the condition of out-of-balance that existed in the rotor.

Consider the conditions existing at the bearing—there is the centrifugal pressure, the resistance of the bearing to move, which has been called its "stiction," and the inertia of the mass of the rotor; before the spring can be compressed the centrifugal forces have to overcome the stiction and the inertia of the rotor. The latter is reduced to a negligible quantity by not allowing the rotor to move beyond what is necessary to just free the piece of paper, and the spring balances the centrifugal pressure minus the stiction. A direct reading of the strength of the spring by itself, therefore, would be too little by the amount of the stiction, but by pulling against the bearing with a spring balance, the resistance of the spring and the stiction are taken account of, so that the spring balance reading should approximate very closely to the centrifugal pressure; especially so if, during the taking of readings with the spring balance, care is taken to simulate the molecular vibration occurring when the rotor is spinning by tapping the bearing lightly with a hammer. We thus have the measure of the centrifugal pressures acting at the centre of the selected points, viz., the centres of the bearings, and we also have the angles at which these pressures are acting as given by the spiders. But the bearings are not convenient points at which to attach or remove weight; it is necessary, therefore, to transfer these forces to the planes on the rotor which may be selected as the most convenient at which to balance the rotor. Having selected these planes, it is then necessary to convert the centrifugal pressures into force moments and by the aid of vector diagrams transfer them at their proper angle, as ascertained by those diagrams to these planes. These force or weight moments and their angular position on the selected plane relative to the rotor being thus obtained, it is only necessary to convert the weight moments into weights at a radius to suit the rotor, and these weights then completely balance the rotor for the particular condition of out-of-balance that requires correcting.*

It will be noted that in order to measure the centrifugal pressures, the spring balancing that pressure has to be adjusted while the rotor is spinning. Obviously only one reading can be taken at each end during the one spin, and it is advisable, where great accuracy is desired, to obtain at least three readings, which means spinning the rotor three times for one end and another three for the other end. If, therefore, some instrument could be utilized instead of the spring which would record the centrifugal pressures, and be at the

*Vide Professor W. E. Dalby's book "Steam Power," page 486. Publishers, Ed. Arnold, London, 1915. Also "The Balancing of Engines," by same author. 1902 Edition, p. 37.

same time interconnected with the tachometer, a considerable gain in time would result, as several readings could be made during the one spin, and greater accuracy would also follow. Some attempts have been made in this direction but, so far, without success. It will be seen that it is not a simple problem, as the centrifugal pressure is an alternating one, varying in amount with the speed at every instant, and also depending upon the extent of the out-of-balance being corrected, and it is further complicated by the fact that the rotor must not be allowed to vibrate.

The one chief advantage of the method described above is that the position on the rotor where it is most convenient to place or remove weights to balance it can be not only selected at will, but also from the vector diagrams the correct weight moment to place at that position can be accurately determined, assuming, of course, that the means adopted for measuring the forces are also accurate. In other words, instead of having to guess the amount of weight to be added or deducted, it is now possible to determine its correct amount.

In the cast of rotors like a turbine rotor, it is a comparatively simple matter to select the position for adding or removing the balancing weights, but in the cast of propellers where there is not a continuous circle of metal it may happen that the angular position where weight has to be removed will fall between the blades, and as, moreover, weight cannot be removed from the blades in any one concentrated spot, but has to be spread over a wide area, the determination of the amount to be removed becomes more difficult, but no reason is seen why the surplus metal should not be removed wholly from the blades, as by author's method the position on the boss relative to its fore and aft length can be selected at will within limits, and the weight to be removed from that position can be accurately determined from the vector diagrams.

This method of solving the problem of determining the amount and position of the weights required to correct the out-of-balance of a rotor has been fully tested, but the details of these tests would add too much to the length of this paper.

For this final solution of this part of the problem, the author is indebted to Mr. C. C. Dudley, of the Engineering Department's drawing office staff of the Naval Dockyard at Cockatoo Island, inspired by Professor Dalby's classical work on "The Balancing of Engines."

The determination of the amount and position of the out-of-balance hence involves three stages:

(1) Spider reading—at alternate ends —opposite end stationary—giving the resultant planes of unbalance—best obtained by plotting the spider pin readings graphically.

(2) (a) Measurement of centrifugal pressures—at alternate ends—opposite end fixed: (b) Tachometer readings — giving revolutions per minute.

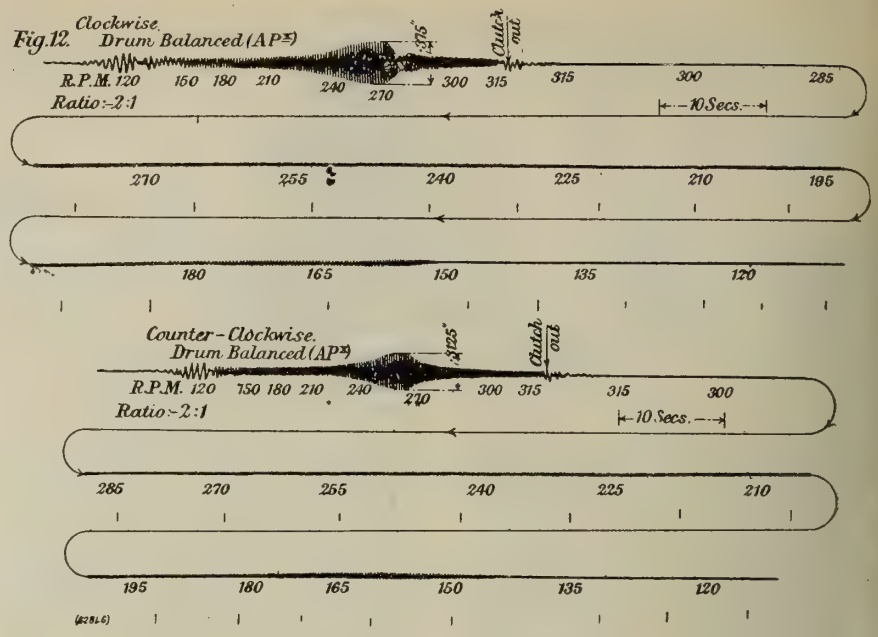


FIG. 12—VIBRATION DIAGRAM.

(3) Vector diagrams — couple and force diagrams, referred to the plane selected for adding or removing weight.

As regards the spider readings, the following notes will assist in making the necessary deductions:

(a) When the spider readings at either end are at the same angle, the out-of-balance is one of pure static unbalance, see Fig. 1.

(b) When spider readings are at 180 deg. with each other, the out-of-balance will be either one of pure dynamic unbalance (vide Fig. 2) or one of dynamic unbalance, combined with one of static (vide Fig. 4), lying at the same angle as the dynamic unbalance.

(c) When spider readings are at any angle to each other, other than those given in (1) and (2) above, the out-of-balance will be a combination of dynamic and static unbalance (vide Fig. 3).

A little consideration of the principle of the vector diagram will show that in cases (a) and (b) vector diagrams are not required, as the balancing weights can be directly determined from the centrifugal pressures by calculation; also that vector diagrams are always necessary when the spider readings are at some angle other than the same or at 180 deg. with each other, but conditions (a) and (b) are more the exception than the rule.

It was thought at one time that the question of the size and strength of the controlling springs would be a determining factor, but it will be now seen that they do not enter into the problem so far as the spider readings are concerned, other than in selecting such a spring as will control the amplitude of vibration within reasonable limits, and as regards this from certain tests made with three different springs—which were all of the same size, viz., 6¼ in. long, 4 in. mean diameter with six coils, except that the size of the steel varied, being ¼ in., ⅝ in. and ¾ in. diameter respectively, giving compression strengths of 270 lbs., 600 lbs. and 1,250 lbs. per inch compression respectively—it was found that the speed at which the maximum amplitude occurred with two equal weights in line at opposite ends, were approximately 80 r.p.m., 140 r.p.m. and 180 r.p.m. respectively; whereas, when the weights were diagrammatically opposite each other and at opposite ends, the speeds were approximately 150 r.p.m., 220 r.p.m. and 310 r.p.m. respectively, and further, the stiffer springs gave larger amplitudes than the weaker springs.

The relative speeds for the three springs in each case follow the law governing the strength of springs, but no explanation can be given for the difference in speeds under the two conditions of unbalance given, and the author would not like to say at this stage whether this difference will hold good in all similar cases, or with a different form and weight of rotor.

The author thinks that he may claim that the solution of the problem, by the method offered here, of determining the position and amount of the out-of-balance, removes the balancing of rotors out of the realm of trial and error to one of exactitude and precision, and that the adoption of this method will save not only a great deal of time, but also no little loss of temper in the tester.

Note on the Influence of Running Balance of Propellers on the Vibration of Ships

In the author's paper on the above subject, which he had the honor to present to the members of this Institution in 1917, the effect of dynamically balancing propellers in reducing the vibration of ships was discussed. In this short note, the further experience gained in two vessels by thus treating their propellers is given. Since the author's last paper, there has been, owing to the

war, no opportunity to gain further experience in warships, but thanks to the enterprise of the Union Steamship Company of New Zealand, who had the propellers of two of their vessels dynamically balanced, it is possible to further show the advantages gained by this treatment. The vessels were: The S.S. Niagara, 525 ft. by 66¼ ft. by 34½ ft., 13,415 tons gross; speed, 17 knots, triple screw ship; and the S.S. Loongana, 300 ft. by 43 ft. by 23¼ ft., 2,448 tons gross; speed, 17 knots, also a triple screw ship.

In the Niagara, the wing screws are driven by the usual type of vertical marine engine, and the centre screw by a direct-driven low-pressure turbine. The owners decided they would have the centre screw dynamically balanced, and this was done at the Naval Dockyard, Cockatoo Island, Sydney. The author was able to obtain vibration diagrams both before and after the propeller had been balanced, and the results given by these diagrams are given in the attached figure. The speed of the wing propellers was 80 r.p.m. to 85 r.p.m., and the centre one 200 r.p.m. to 220 r.p.m. The author has received the following letter (dated June 5, 1919) from the marine superintendent of the Union Steamship Company of New Zealand, which speaks for itself:

R.M.S. Niagara—Combination Engines. Wing Engine Reciprocating. Centre Low-Pressure Turbine.

In reference to the Manganese Company's propeller for this steamer, which was bored out and dynamically balanced at the Naval Dockyards in November, 1917, and fitted on the Niagara at the end of December, 1917, I am pleased to say the results have been very satisfactory for same. The vibration is considerably reduced. The propeller shows the same efficiency as the original one made by the Manganese Bronze Company. The revolutions from the reciprocating engines vary from 85 per minute to 88 per minute, and the turbine propeller from 210 per minute to 220 per minute. The chief engineer wrote me from Auckland (January, 1918) in reference to this propeller, in the following terms: The vibration records were taken under very similar conditions as regards weather. The records show less vibration; of course, there is more difference felt than recorded. The pipes under the promenade deck, which used to rattle badly at times, were quiet, also steering-house doors and loose fittings, such as window frames, bad fitting rails, etc. The second-class accommodation, captain's room, too, are also much improved. Of course, the conditions are the best; when we get bad weather and oil bunkers practically empty, there may be more vibration, but up to the present the propeller is a success.

The Loongana, which is fitted with three Parsons' turbines, also had three propellers dynamically balanced, and three statically balanced at the Naval Dockyards. The ones which were dynamically balanced show a great improvement in having less vibration. After these had been on a few months, they were changed to the statically balanced set for experimental purposes, and we at once noticed a considerable change in increased vibration. Unfortunately, with the Loongana in the

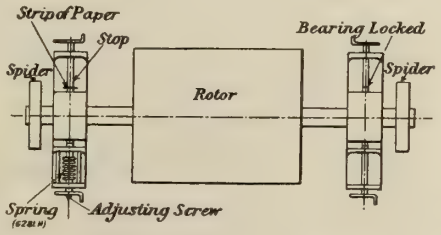


FIG. 13—DIAGRAM OF MACHINE.

trade she is working on, considerable propeller damage takes place in the shallow parts of the Launceston River, and it is impossible to keep any propeller any length of time without damage and being put out of balance.—(Signed) J. Smith, Local Supt. Engineer.

Considerable difficulty was experienced in obtaining a suitable position in the Niagara for the vibration recorder, but the results obtained, although the vibrations recorded were of small amplitude, were sufficiently distinct to show the reduction in vibration effected by dynamically balancing the centre propeller. This particular instance, it is considered, is of more than usual interest, in that the speed of the balanced propeller was comparatively slow, and that although only one of the three propellers was balanced, yet such satisfactory results were obtained.

It may be observed that the Niagara is a passenger vessel plying regularly between Sydney, New Zealand and Canada, and anything that can be done to increase the comfort of any such vessel must be evidently greatly appreciated. In the Loongana, all three propellers were turbine driven, and their speed

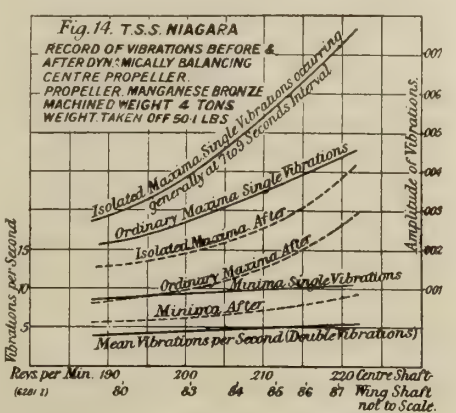


Fig. 14. T.S.S. NIAGARA
RECORD OF VIBRATIONS BEFORE & AFTER DYNAMICALLY BALANCING CENTRE PROPELLER.
PROPELLER MANGANESE BRONZE
MACHINED WEIGHT 4 TONS
WEIGHT TAKEN OFF 50-1 LBS
Isolated Maxima Single Vibrations occurring generally at Two Seconds Interval
Ordinary Maxima Single Vibrations
Isolated Maxima After
Ordinary Minima Single Vibrations
Minima After
Mean Vibrations per Second (Double Vibrations)
Vibrations per Second
Amplitude of Vibrations
Revs. per Min. 190 200 210 220 Centre Shaft
80 83 84 85 86 87 Wing Shaft
not to Scale.

FIG. 14—SS NIAGARA DIAGRAM.

was about 500 r.p.m. Unfortunately it was not possible to obtain vibration records on this vessel before the balancing was effected, and evidence of the resulting reduction in vibration can only be given on the word of the owners, as shown in their letter quoted above.

LARGE INCREASE OVER LAST YEAR

A satisfactory Year.—A greatly increased profit is shown by the Ontario Steel Products Company, Ltd., for the year ending June 30, the figures being $315,900, as against $198,770 in the previous year. The company has been improving its position, having paid off arrears of dividend on preferred stock and authorized a dividend of 8 per cent. per annum upon the common stock for the full year ending June 30, 1921, payable quarterly at 2 per cent. President W. Wallace Jones reports a successful year's business. "Notwithstanding a substantial reduction in our prices during the past year," he says, "our output in value and tonnage was the largest since incorporation. Earnings from specialties show an encouraging increase, and sales of old or obsolete stock omitted in previous inventories contributed substantially to the profits as shown. Since the first of January, domestic shovel business has been brisk, and an extension to this work is in contemplation. Export trade is still being outlined, but in smaller volume than last year. All our original factories have been employed to about capacity during the year, and manufacturing was commenced in the Central Spring Works, Oshawa, early in April. Necessarily, our output at that point has been small up to the present time, but it is expected that a satisfactory tonnage will be produced during the coming year."

SALE OF U.S. SUBMARINE CHASERS

The United States Government are offering for sale a number of wooden submarine chasers, equipped with three Standard Marine gasoline engines, of six cylinders each. These engines develop 220 h.p. each at 460 revolutions per minute. The boats have a cruising radius of 1,200 miles, and develop a speed of 18 knots. They are to be sold at about $12,500 each, and they cost $80,000 each to build. They will be sold for cash or on the deferred payment plan. They are to be seen on application to the commandant of the U.S. naval district, where they are laying, which include Boston, Brooklyn, Philadelphia, Norfolk, Charleston, Key West, New Orleans, Puget Sound and Cristobal C.X.

FUEL OIL AT PANAMA CANAL

Price of fuel oil at canal terminals will be increased to $3.50 per barrel, effective August 1, 1920. Bunkers will be limited to sufficient oil to reach next bunkering station. This will apply to all ships whether they have contracts with local oil companies or not. Notify shipping and oil interests and others concerned immediately by publication and otherwise.

Design and Construction of Marine Shafting

The Report of the British Marine Engineering Design and Construction Committee of the Institute of Marine Architects on the Subject of Marine Shafting is Here Given.

The important report of the British Marine Engineering Design and Construction Committee of the Institution of Marine Architects has just been issued, and is reproduced below:

MARINE SHAFTING
SECTION 1.—NOMENCLATURE AND DEFINITIONS

Line of Shafting

1. A line of shafting in a screw steamship consists of the motor shaft at one end and the shaft to which the propeller is fixed at the other, together with the shafts between them.

Motor Shaft

2. The motor shaft of a reciprocating engine is the crank shaft, and of a turbine engine is the rotor shaft. With an electrical drive it is the rotor or armature shaft.

Tail Shaft

3. The shaft to which the propeller is fixed shall be called the tail shaft.

Tube Shaft

4. When the tail shaft is entirely outboard, the shaft which passes into the inside of the ship shall be called the tube shaft.

Outboard Intermediate Shaft

5. When there is a shaft interposed between the tail shaft and the tube shaft, it shall be called the outboard intermediate shaft.

Intermediate Shafts

6. The shafts connecting the tube shaft with the motor shaft shall be called the intermediate shafts.

Thrust Shaft

7. The shaft having one or more collars formed upon it for the purpose of resisting the longitudinal thrust on the shaft, shall be called the thrust shaft.

Couplings

8. The flanges forged solid with a shaft, or welded to the body, and other portions forged with, or fixed to the shaft, whereby the shaft may be connected to other shafts, shall be called couplings.

Coupling Bolts

9. When two shafts are connected together by fitted bolts with heads or with taper bodies, secured in place by nuts, these bolts shall be called coupling bolts.

Driver Bolts

10. Those bolts having plain cylindrical bodies without heads, which are secured to the coupling of one shaft by nuts, and are free to move longitudinally in the holes of the coupling of the adjacent shaft, shall be called driver bolts.

Spindles and Shafts

11. With geared turbines the shafts carrying the pinions and gear wheels, shall be called as follows:

Motor Shaft

12. The motor shaft is the shaft of the rotor of a turbine or electric motor.

First Pinion Spindle

13. The first pinion spindle is that which is coupled to the motor shaft and carries the pinion which gears into the wheel of the next spindle or shaft.

Second Pinion Spindle

14. When there is double gearing the second pinion spindle is that which carries the wheel driven by the first pinion and also the second pinion which drives the wheel on the next spindle or shaft.

Main Wheel Shaft

15. The main wheel shaft is that which carries the final wheel and is coupled to the intermediate shafting.

16. When more than one turbine is geared separately to each line of shafting on account of there being more than one turbine to each, the spindles shall have added to their designations H.P., M.P., L.P. respectively, and the prefix S. or P. shall denote starboard or port shafting, e.g., S.H.P., P.L.P., etc.

Built Crank Shafts

17. The parts of the shaft containing the couplings shall be called coupling shafts. The part shrunk into the two webs shall be called the crank pin. The arms connecting the crank pin and the coupling shafts shall be called crank webs.

Shafting Bushes. Stern Bush

18. The aftermost bush, next to the propeller and supporting it and the tail shaft end, shall be called the stern bush, whether it be fitted in a bracket or in the after end of a stern tube.

Intermediate Bracket Bushes

19. When there is more than one bracket for the support of outboard shafting, the bushes in those intermediate between the aftermost one and the stern tube end shall be called the intermediate bracket bushes.

Bushes In Stern Tubes

20. When there are no outside brackets for the support of outboard shafts, and the tail shaft is within the tube, the after bush in the stern tube shall be called the stern bush, but when the tail shaft is outside the tube this bush shall be called the stern tube after bush.

21. The bush fitted at the forward end of the stern tube and within it contiguous to the stuffing box shall be called the stern tube forward bush.

Shaft Liners

22. A continuous liner is one extending over the whole length of the shaft which is covered by the stern tube and its appurtenances (see Section IV, No. 2).

SECTION II
Materials for Shafting

1. Shafts generally may be made wholly of ingot steel, wrought iron bars cross piled, scrap wrought iron, or of scrap mild steel, and they may be wrought by hammer, press, or when in straight lengths by rolling mill.

2. If scrap is used it must be of uniform quality, and be thoroughly cleaned and examined after "rumbling."

3. A mixture of steel scrap and iron scrap is not permitted, and no tail shaft, thrust shaft, nor crank shaft journals and pins shall be made of forged scrap steel.

4. If scrap mild steel is used none of it should be from steel exceeding in tensile strength 32 tons per square inch.

5. When ingot steel is used it must be such that after forging or rolling the tensile strength in tons per square inch added to its elongation per cent. when measured on the British Engineering Standards Association test pieces "C," "D," or "E," shall be not less than 57.

6. All conditions and tests of materials other than herein mentioned shall be in accordance with the rules and regulations laid down by the British Engineering Standards Association for Ingot Steel Forgings and Steel Castings for Marine Purposes (Nos. 29 and 30.)

7. In ingot steel shafts made by rolling, when couplings are formed from the shaft by upsetting, the test pieces shall be cut from the outer edges of the couplings.

8. Ingot steel for shafts shall be generally of 28 to 32 tons tensile standard quality.

9. Steel of a higher tensile strength, when required, may be used by special arrangements with the department or register society concerned. In such cases the conditions of paragraph 5 shall apply.

10. The webs of built-up crank shafts may be made of ingot steel, wrought iron, or scrap mild steel forged, rolled or pressed; they may be also of steel cast to shape with eye-holes suitable for boring to size.

11. If the webs of built-up crank shafts are made of forged or rolled ingot steel, or are steel castings, the material generally must be such that

the tensile strength does not exceed 32 tons per square inch, and the sum of the tensile in tons and the percentage of elongation measured on the British Engineering standards Association test pieces "C," "D," or "E," shall not be less than 50 for castings.

12. The couplings of wrought iron or scrap steel shafts may be welded to the body, those of ingot steel shafts may be forced from the solid, or formed by upsetting the shaft ends by hydraulic pressure. The couplings may also be made separately of ingot steel, wrought iron, or scrap mild steel forged, or they may be steel castings, but the design must be such that provision is made for the astern pull, either by checked rings or other approved means.

13. Couplings when separate from the shafts and coupling bolts may be of wrought iron or forged steel, but in order to facilitate removal they should not be of the same grade of material as that to which they are driving fits.

SECTION III

Rules for the Diameter of Shafts. Turbine-Driven Shafting

1. Turbine-driven installations shall have shafts the diameters of which shall be not less than as given by the following rules:

The diameter in inches of the Intermediate shafts

$$=\sqrt[3]{\frac{\text{S.H.P.}}{R}}\times F.$$

The S.H.P. is the maximum designed horsepower to be transmitted through the shaft and R is the number of revolutions per minute at that power.

(1) For ocean-going and cross-channel ships such as would have a No. 1 or a No. 2 certificate of the Board of Trade if carrying passengers, F=64.

(2) For ships coasting or working on estuaries, rivers, lochs and lakes where the water is habitually smooth, and which would have the No. 3, No. 4 or No. 5 certificates of the Board of Trade if carrying passengers, F=58.

Shafting of Reciprocating Steam Engines

2. Reciprocating steam engine installations shall have shafts the diameters of which shall be not less than as given by the following rules, where

D is the diameter in inches of the low-pressure cylinder, or the equivalent diameter where two or more low-pressure cylinders are used.

S is the stroke of piston in inches.

P is the working pressure in the boiler in lbs. per square inch.

r is the ratio of the swept volume of the low-pressure cylinder or cylinders to that of the high-pressure cylinder. Then

(1) Diameter in inches of the Intermediate Shafts

$$=\sqrt[3]{\frac{D^2\times S\times P}{f(r+2)}}$$

The following are the various values of f

Gen. Description of Engines.	Service of Ships No. 1 (1) as above.	No. 1 (2) as above
(a) 2 Cranks at 90°, cylinder, compound, triple, or quadruple	1,800	2,000
(b) 2 Cranks at 180°, cylinders, compound, triple, or quadruple	1,260	1,400
(c) 3 Cranks at 120°, cylinders, compound, triple, or quadruple	2,000	2,250
(d) 4 Cranks, balanced, cylinders, compound, triple, or quadruple	2,000	2,250
(e) 4 Cranks at 90°, cylinders, quadruple	1,900	2,150

(2) Crank shafts for the various engines shall have a diameter not less than 1.05 times that required for the intermediate shafts.

(3) The diameter of thrust shafts transmitting torque shall not be less in way of the collars than 1.05 times that required for the intermediate shafts. This may be tapered down outside the collars to the size required for the intermediate shafts.

(4) The tube shaft diameter shall be in no part less than 1.05 times that required for the intermediate shaft, and any part of it in the tube exposed or likely to be exposed to sea water shall be not less than 1.075 times that required for the intermediate shaft.

(5) The wheel shaft diameter of a geared turbine-driven installation shall be not less than 1.05 times that required for the intermediate shaft where there are two pinions geared into its opposite or nearly opposite to one another.

Where there is only one pinion gearing into the wheel, or where there are two sets at an angle less than 120 deg., the diameter at the wheel and the adjacent journal shall be not less than 1.1 times that required for the intermediate shaft. Abaft the journal the diameter may be tapered to 1.05 times that required for the intermediate shaft.

3. Tail shafts within the stern bush, whether in the stern tube or in the bracket, shall be not less in diameter than given by the following:

$$\text{Diameter in ins. of Tail Shaft}=d+\frac{P}{K}$$

d is the diameter in inches required for the intermediate shaft of the installation.

P is the diameter in inches of the screw propeller.

The value of K in the various cases is as follows:

Description of engine	Service of ship	Value of K when The liner is continuous	Value of K when The liners are non-continuous
Turbines or electric motors	Ocean and cross-channel	144	144
Reciprocating engines in gen.	Ocean and cross-channel (Nos. and 2 certificates B.T.)	120	100
Reciprocating engines, turbines and motors	Smooth water (Nos. 3, 4 or 5 certificates B.T.)	144	120

Tail shafts which are in stern tubes may have the end forward of the stern gland tapered down to a diameter at the coupling flange equal to 1.05 times that required for the intermediate shaft.

The taper of tail shafts at the propeller boss should be at the rate of 1 in 12; that is, a reduction in diameter of one inch to the foot, the starboard and all intermediate shafts must be of sufficient size to avoid bending under their own weight or inertia to such an extent as to cause whipping.

The maximum unsupported length of shaft, that is the distance apart of their bearings as measured from their inner edges, shall be in accordance with the following rules:— When the maximum number of revolutions is R per minute.

For solid shafts whose diameter is d in inches

(a) L the length in feet $=F\sqrt{\frac{d}{R}}$

For hollow shafts whose diameter is d and the bore is d_1, both in inches.

(b) L the length in feet $=F\sqrt[4]{\frac{d^2+d_1^2}{R_2}}$

For the outboard shafts of sea-going ships ..... F=125

For the inboard shafts of sea-going ships ..... F=145

For the shafts generally of ships habitually working in smooth water .... F=160

SECTION IV

FITTINGS AND DETAILS

Bronze Liners On Shafts

1. The thickness of the liners on tail shafts or tube shafts when so fitted and newly made and fixed to the shafts should not be less than given by the following rule:—

Thickness of liner in way of bushes and stuffing box in 64ths of an inch $=13\sqrt{d}$

The thickness of a continuous liner in the part between the bushes in 64ths of an inch $=10\sqrt{d}$.

d is the diameter in inches of the shaft within the liner.

2. By a continuous liner is meant a liner of which the whole length is cast in one piece, or one which is made of two or more lengths and in which the junctions of the separate pieces are made by electric welding or by fusing through the whole thickness of the liners. Joints shall not be made by butting, overlapping, stepping, or by soldering with soft solder.

3. The liners must be made of good bronze, soundly cast, free from blow-holes, sponginess, and cracks.

4. Liners must be carefully shrunk on, or be forced on the shaft by hydraulic pressure and no pins to secure them shall be fitted.

5. All liners on shafts should be tapered down beyond the bearings at their ends to half their thickness whenever possible to avoid abrupt changes in diameter.

6. The liner at the tail shaft end should be made to enter a recess in the propeller boss which shall be deep enough to prevent the possibility of the liner butting at its end when the boss is driven home.

Effective means for excluding water from this recess in the boss must be provided.

7. The length of the bearing part of the stern bush next to the propeller and supporting it and the shaft shall be not less than four times the diameter required for the shaft within the liner at that part.

Coupling Flanges and Bolts

1. The thickness of the coupling flanges at the pitch circle of the bolt-holes shall be not less than the diameter of the coupling bolt at the face of the coupling. The thickness of the tail shaft coupling shall not be less than ¼ of the diameter required for the intermediate shaft.

2. The radius of curvature at the fillet where the flange starts from the shaft shall be not less than 0.125 × diameter of shaft adjacent to the flange.

3. The coupling bolts shall be in diameter at the joining faces not less than that given by the following rule:

$$\text{Diameter of coupling bolts} = \sqrt{\frac{d^3}{3.5n \times r}}$$

d is the diameter in inches required for the intermediate shaft.

r is the distance in inches of the centre of the bolt-holes from the shaft axis.

n is the number of bolts in the coupling.

4. The diameter over the thread of the coupling bolts should be at least ⅛ inch less than that of the body of bolts which do not exceed 1.75 inches; for bolts over 0.75 inches and up to 3 inches in diameter, the reduction should be at least ¼ inch, and for those over 3 inches it may be ½ inch.

5. The tips of coupling bolts should be made slightly taper and should be ¼ inch less in diameter than the bolts at the bottom of the threads and not less in length than ⅜ths the diameter of the bolts.

Crank Webs of Built Shafts

1. The crank webs of built shafts whose diameter abaft the web is d, shall be such that if h is their thickness measured parallel to the axis and the thickness of metal around the shank eye-holes measured radially.

Then h should not be less than $0.625 \times d$; $h \times t^2$ should be not less than $0.12 \times d^3$, or

The thickness around shank hole

$$= \sqrt{\frac{0.12 \times d^3}{h}}$$

2. Crank webs should be securely shrunk or forced on by hydraulic pressure and fitted with one or two keys or cylindrical dowels.

The diameter of dowel if only one is fitted $= 0.18 \times d + 0.2$ inch

or the dowel may be in diameter 0.2 inch for each inch of diameter of shaft.

Keys of Screw Propellers

1. Tail shaft propeller keys shall be designed to have a nominal pressure of not more than 11,000 lbs. per square inch on the side of the key above the shaft.

The breadth of the key shall be not less than 2 × its thickness, all dimensions being in inches.

When the propeller boss is made of bronze, the thickness of the key should be increased by 12.5 per cent., and the added portion should stand outside the keyway in the shaft.

The screw for the nut on the tail shaft end shall have a diameter of not less than 0.7 times the diameter of the shaft and the length of the nut shall not be less than 0.5 times the diameter of the shaft.

TWO GREAT SHIPS IN COMMISSION AGAIN

TWO notable vessels have resumed their place on the Transatlantic route between the United Kingdom and New York. They are the "Aquitania" and "Olympic," and both have been laid up for some time being reconditioned and converted from coal burning to oil burning, after their strenuous war service. This will make a great addition to the passenger space available on this route, and in the present state of congestion will be heartily welcomed. Both vessels are of the highest class of passenger carrying liners, and combine comfort with a reasonable amount of speed. The following description of the oil fuel installation in the "Aquitania" will give a good idea of the general arrangement of the apparatus for a vessel of this class:

In the "Aquitania" the White low-pressure mechanical system has been adopted, the oil being forced through the jets of the burners by pumps at a pressure normally of about 60 lbs. per sq. in., rising to a maximum of about 110 lbs., according to conditions. As the four boiler rooms of the vessel contain 21 double-ended boilers, each with eight furnaces, 168 burners are required in all. A complete installation of pumping and heating plant has been supplied by Messrs. Brigham & Cowan, of South Shields, in duplicate for each group of three boilers; that is, in each of the three forward boiler rooms, which contain six boilers apiece, arranged in groups of three across the ship, there are four sets of heating and pumping plants, while in the aft boiler room, with three boilers, there are two sets. Two settling tanks are provided for each group of three boilers. For the full length of the boiler rooms two suction and filling mains, 8-in. in bore, are fitted, one port and one starboard. In each boiler room these mains are cross connected, and in addition shut-off valves are provided, so that the system in one boiler can be entirely isolated from any other boiler room. In all, something like 16 miles of pipes have been required for the oil-fuel installation.

Storage Tanks

The bulk of the oil is stored in the wing bunkers which were formerly used for coal, and a great deal of work has been entailed in making these suitable for their new use. It has been necessary to stiffen the bulkheads in order to avoid the risk of deformation from the weight of the oil pressing against them, to fit transverse wash bulkheads, and to render the plate joints thoroughly oil-tight, the method adopted for this purpose being in general to fit stout double-riveted joggled plate straps over each plate landing. In addition large athwartship bunkers have been arranged forward of No. 1 boiler room, between boiler rooms Nos. 1 and 2, and between boiler rooms Nos. 2 and 3, but even these with the wing bunkers did not provide the desired capacity of 7,600 tons, and accordingly six of the double bottom tanks have been made suitable for oil carrying. The reason why greater use was not made of the cellular double bottom, thus releasing the original side coal bunkers for cargo, is that the "Aquitania" is not a cargo-carrier, and the space would not have been of much advantage to her.

For filling the bunkers there are four connections on each side of the ship, and if all the connections on one side were in use simultaneously she could be completely bunkered in six hours. Each tank is provided with a Pneumercator gauge, by Messrs. Kelvin, Bottomley and Baird, of Glasgow, which enables the depth and quantity of oil to be ascertained at any time, and electric float alarms are fitted which ring a bell whenever the level of the oil reaches the 95 per cent. of full capacity to which it is usual to fill the tanks. As a further precaution against over-filling a special arrangement of air and overflow pipes has been fitted by means of which, in the event of a tank being over-filled, the oil will overflow into one of the storage tanks provided for the purpose. An overflow storage tank is provided in each group of tanks in each boiler room, port and starboard. Heating coils, to ensure the free running of the

oil in cold weather, are fitted in the wing bunker and double-bottom tanks, but not in the cross-bunker tanks, which it is considered will receive sufficient warmth from the adjacent boiler rooms.

Settling Tanks

From the storage tanks the oil is pumped by large vertical direct-acting Weir pumps to the settling tanks. Two of these transfer pumps are fitted in each boiler room, those in the small boiler room being of 70 tons per hour capacity each, and those in the three large boiler rooms of 100 tons. The capacity of each settling tank is such as to ensure 16 hours' supply for three double-ended boilers, so that about 15 hours will be allowed for the settling of the oil in one tank while the other tank is in use. To facilitate separation of water from the oil heating coils are fitted in these tanks, which also have Pneumercator gauges and electric float alarms. The removal of the settled water from the tanks is done by the transfer pumps, which have special connections for this purpose, so arranged that it will not be possible for the pumps to draw oil from the settling tanks and discharge it overboard.

Supply to the Boilers

From the settling tanks the oil pressure pumps take their supply through suction strainers, discharging through the heaters and discharge filters to the burners in the furnaces. A ring main is fitted in each boiler room to which each pumping unit is connected. An emergency connection is also made to this ring main, so that the pressure pumps can draw direct from the oil storage tanks.

Special attention has been given to the fire extinguishing arrangements. An installation of foam apparatus, which smothers any oil fire by means of a foam or froth containing carbonic acid gas, is fitted, and there are numerous hand-extinctures and trays of sand arranged all over the boiler rooms. To enable the presence of loose oil on the double-bottom tank tops to be quickly detected, skeleton flooring is provided for the stokehold, and the broad working gangways in front of the furnaces are kept well clear of the bulkheads, so as to leave an open space through which the tank top and gutters may be seen. No wood has been used in the flooring. The insulation of the boilers has been increased in order to keep the temperature of the boiler rooms as low as possible.

Advantages of Oil-Firing

Important advantages must obviously have been anticipated from oil-firing by the Cunard Company before they decided to face the cost of conversion and the loss of revenue incurred by laying up the ship for eight months while the necessary work was being carried out. Among them is the increased duty yielded by the boilers. With coal-fired boilers there is always a considerable loss of steam every watch, through the burning down and cleaning of the fires. In the "Aquitania," if 28 out of the 168 furnaces are cleaned every watch, approximately 8,000 h.p. is lost every 24 hours. With oil-firing there is no such loss. The cleaning of the burners required is trifling, the oil can be supplied continuously, and the heating is maintained so that the steam pressure is constant, and thus the speed of the vessel improved. An even temperature being kept up in the boilers, the bill for repairs will be considerably reduced. There will be no ashes to be removed, and consequently no dust and inconvenience from that source, while the absence of noise and dirt during bunkering is a matter of some consequence in a vessel of the type and size of the "Aquitania."

Special attention has been given to the accommodation provided for the oil-fuel attendants and cleaners. Cabins containing two, three and four berths have been fitted up for them, constituting a new standard of comfort.

BRITISH TRADE COMMISSIONERS' REPORT

Canada's trade, like that in other parts of the world, has been subject to restrictions imposed during the war period, but has been affected more particularly by the difficulties connected with shipping, states the British Commissioner in his trade report for 1919. While official restrictions in respect to trade have been largely removed, and although the situation regarding shipping is more favorable than it was, conditions in regard to the latter are far from normal.

The Canadian Government Merchant Marine, Limited, operated a service in 1919 between Montreal, Halifax and St. John, Liverpool, London, Glasgow and Avonmouth. From Montreal and Halifax boats were also operated to Buenos Ayres, Newfoundland, Havana, British West Indies, and from Vancouver to Australia. The service will be extended in 1920. In addition to these Government services, various new lines have been started by private companies of which the following are particulars:

The Marine Navigation Company, Ltd., is performing a service between Canada and France, sailing during the season of navigation between Montreal and St. Nazaire. La Compagnie Canadienne Trans-Atlantique, Ltee, is now performing a frequent service between Montreal and Havre. They have several freight boats on the route, and two of their steamers also carry second-class and improved steerage passengers.

A regular monthly service has been started between Canada and South America, sailing during the season of navigation from Montreal to Montevideo, Buenos Ayres, and Bahia Blanca by the Houston Lines. They have steamers of 8,000 tons on the route. A direct service has been commenced between Canada and Norway by the Norwegian America Line, which loads vessels from Montreal to Bergen, Stavanger and Christiania. Sailings are being made from Montreal to Antwerp by the Canadian Pacific Ocean Services-Furness Line. The Canadian Pacific Ocean Services, Ltd., are running two of their regular passenger steamers between Montreal and Havre. Most of the old ocean services which were being performed before the war broke out are running again, including the following: Head Line, from Montreal to Belfast and Dublin; New Zealand Shipping Co., Ltd., from Montreal to Australian and New Zealand ports; Elder Dempster Line from Montreal to South African ports; Manchester Line from Montreal to Manchester; Furness Line from Montreal to London and Hull; White Star-Dominion Line from Montreal and Quebec to Liverpool; Anchor-Donaldson Line from Montreal to Glasgow, London and Avonmouth; and the Canadian Pacific Ocean Services, Ltd., from Montreal to Liverpool and Glasgow.

On the Pacific there are the Canadian Australasian Royal Mail Line, from Vancouver to New Zealand and Australia; the Canadian Pacific Ocean Services, to China, Japan, and Manila; and the Pacific Coast S.S. Co., from Victoria to San Francisco. All the Montreal services mentioned above will no doubt be changed to St. John and Halifax on the close of St. Lawrence navigation.

The absence of direct steamer services either from the Atlantic or the Pacific Coast is one of the main handicaps to Canadian-Indian trade. Shipments of Canadian exports from the Atlantic Coast can be sent to Glasgow or Liverpool and transhipped to the East. There are certain disadvantages in the matter or transhipment. A fast service also operates from the Canadian Pacific Coast to Japan, China and Hong Kong, and delay is involved in securing a vessel from that port to Calcutta or Bombay. On the question of shipping the British Trade Commission in India and Ceylon makes the following observations:

"It will be extremely difficult to develop a large and satisfactory trade between the Dominion and this market until direct shipping services are inaugurated. On the other hand, at present the trade is not sufficiently important to warrant shipping companies proceeding to Canadian ports in order to embark cargo. The most satisfactory solution of the problem would be the extension of the Canadian Pacific Railway Company's service from Hong Kong to Calcutta So far as Canadian cargo alone is concerned this would not be profitable, but there is a considerable traffic between China, the Straits and Calcutta, a share of which they would be able to secure. A direct service of this kind would do more to stimulate the Dominion's trade with India than any other step which could be taken."

The Marine Engine Cylinder Question in Canada

Demonstrating That Canada, as Usual, Leads All Others, But Has to be Dragged to the Front With a Confession

By JOHN H. EASTHAM

A SUDDDEN shock must have been administered to many readers of Canadian Foundryman, when the allegation that marine engine cylinders cannot be made in this country," was made public in the May issue. Mr. Bell is quiet justified in paving the way for correspondence on the subject, in order that such an absurb canard may be refuted.

As undeniably many failures in the attempt to turn out these castings have occurred during the war, and since the armistice, a little probe into the underlying causes and a few hints at possible remedies, for such a state of affairs as now exists, may be in order.

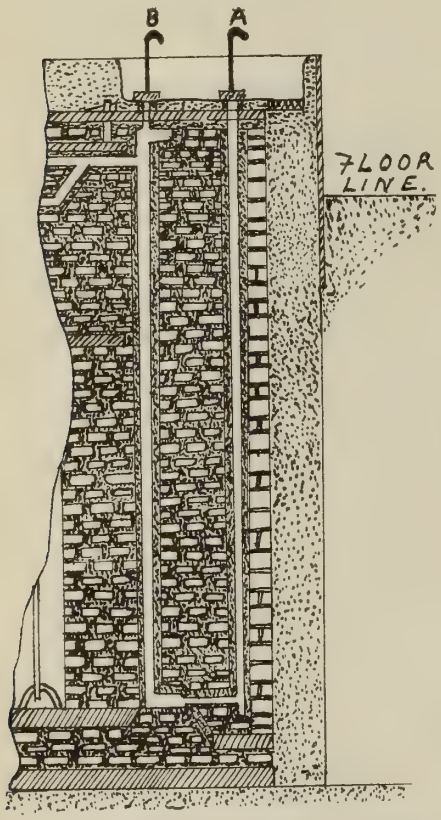


FIG. 1—CROSS-SECTION VIEW OF CYLINDER, SHOWING GATES.

We may first safely assume that this country suffers from a sad shortage of loam moulders, that is beyond question, but what steps are we taking to secure them? I venture to say, hardly any.

The average foundry management, handling a line of work which ought to be made in loam, and desiring the services of a moulder with a knowledge of drawing and ability to work from a spindle, as well as mark out his own rigging on an open sand bed, generally advertises for one in the usual way, and on offering sufficient inducement in the way of wages and cost of transportation, get one to leave another shop where he is probably just as badly needed.

One company's gain is thus another company's loss, and so on, ad infinitum, little effort being made to train men for this branch of the business, notwithstanding that two winter's courses at a good night school or collegiate evening classes, added to two years' of his apprenticeship devoted to loam work; (say, the last two years of his time), will make a finished artist of him in this, the highest branch of our handicraft.

If apprentices are not available, there is a proportion of our sand moulders with sufficient ambition and technical knowledge to qualify as loam moulders by going to that end of the shop and working as assistants to, and under the instruction of, broad-minded men who have served their time to the business.

Horizontal Pouring

Undoubtedly many open-ended cylinders cast horizontally have been scrapped for that very reason, they were made in first-class well-fitted boxes, oven dried, and if poured vertically would in very many cases have successfully passed all tests, the waste of good moulding for this simple reason alone having been criminal, the object usually being to effect a slight saving of the time and labor germane to the operations of turning the closed mould on end and bedding into a pit prior to casting. Penny wise, pound foolish, eh? and when you have carefully made, dried, cored, and closed a mold of this description, gentlemen, do you always pour it properly, or with the correct mixture? You do not, even when cast vertically.

There are a lot of foundry executives and high grade moulders who have never seen or heard of a plugged runner, to their infinite loss, and a good many others, who, having heard and seen, will not go to the trouble of using them.

Fig. 1, is a cross sectional view of a low pressure marine cylinder, made in loam and gated to get the best results, all gates being kept closed by means of the flat disc plugs marked "a", "b", respectively. Plugs "a," "a," are placed over the bottom pour gates, whose inlets may either be attached to the cylinder flange, or that at the steam chest opening, as your fancy or circumstances direct, plugs "b" "b", being placed on those "pop" gates serving the mould by direct drop between the main core and outside cheek.

Alternative ways of building up the runner box are shown to left and right of the plan view at Fig. 2, the straight system to the left being extended for a two ladle pour, and the circular way, shown at the right, for a single large ladle.

Plugs may be of any of the various designs shown at Figure 3, the ball type

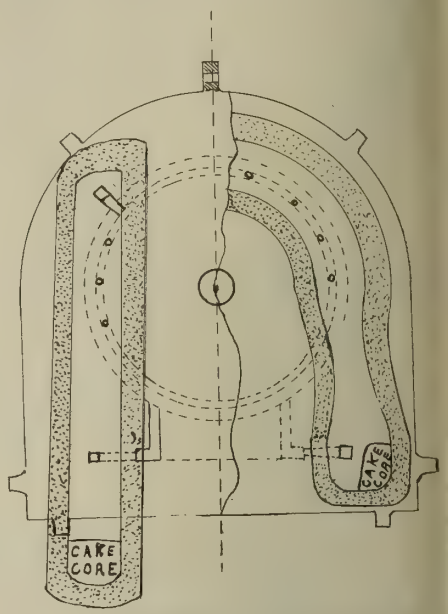


FIG. 2—DIFFERENT TYPES OF RUNNER BASIN.

being perhaps, least liable to disturb the sand in the runner box through careless handling when placing in position, and should be dipped overhead in good blackwash, then thoroughly dried, and the mould poured while they are still hot, as under these circumstances no metal will stick to them, whilst their existence will be greatly prolonged. When pouring, certain men should be told off to stand by with rammers, or long, light rods for the purpose of lifting the plugs at the proper moment; "a" "a", or those serving the bottom gates being removed as soon as the runner box is full of metal, and "b" "b", taken out one at a time to gradually increase the pouring speed as soon as a pool is forme in the bottom of the casting, the tendency to splash and scab being thus eliminated.

And what of your mixture, gentlemen? Are you giving that end of the problem the attention it deserves?

If you melt by analysis, as you ought in justice to yourself and to the class of work under discussion, the following is approximately what you need:

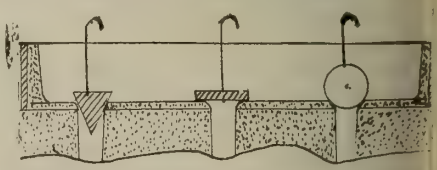


FIG. 3—DIFFERENT DESIGNS OF RUNNER PLUGS.

Silicon,	Sulphur,
Per cent.	per cent.
1 to 1.30	less than 0.10
Phosphorus,	Manganese
per cent.	per cent.
0.20 to 0.45	0.80 to 1.

This for your heavier work, for your medium and lighter cylinder castings a slight increase in the silicon content is permissible, with a corresponding decrease in the manganese per centage, according to your calibre and tonnage. The judicious use of steel scraps and close inspection of your analysis cards forwarded with each shipment of pig you get, will give you the above mixture, or any variation of it that you deem advisable, or, if you do not care to use steel, charcoal pig may be utilized in its place at increased cost.

In conclusion, and by way of vindication of our Canadian institutions, the average man reading this article will be perhaps, surprised to learn that what is probably the best record on marine cylinder work for the past five years, on this continent, is held by an Ontario foundry.

I admit, gentlemen, that the foregoing is a sweeping statement, but here are t figures. Three per cent. loss from all causes on nearly fifty sets of triple expansion engines, or close to one hundred and fifty cylinders, ranging from two to ten tons each.

Anyone doubting and wishing to be convinced may have the name of the firm by communicating with the writer o with the editor, Mr. F. H. Bell, at th office, and if you have a better record to show, produce it, and if ever the days of reasonable enjoyment return, we will celebrate the occasion in due and ancient form at my expense.

CAN CANADA PRODUCE GOOD MARINE CYLINDERS?

By F. H. BELL

Under the above caption I submitted for the benefit of our readers an article in the May issue of this publication, and in this article I pointed out that a prominent marine man had made the remark that it was impossible to secure a successfully cast cylinder for a marine engine in Canada. Of course I did not agree with the statement, but had to admit that we had a grand opening for improvements. I suggested a few things in order to start the ball a-rolling and invited criticism, which incidentaly I might say I received in abundance.

Among the suggestions advanced I pointed out that green sand was not the material from which to make the mold. I pointed out that the mold should not be poured while lying on its side; I also gave a recipe for making loam. In fact I about went the limit in giving advice. and I confidently believe that much good will result from the same.

However, in response to my invitation, I received a communication which gave Millville gravel as the proper material from which to make loam molds, and incidently hinting that it had my receipt skinned in a thousand different ways, which presumably it had. I was endeavoring in receipt book fashion to describe in a general way how to mix loam from material which most foundrymen would be in a position to locate, while Millville gravel is a natural formation containing all the ingredients required and is undoubtedly the cheapest and best in the long run as it is ready to use without the labor and expense of preparing it. It is equally as valuable in making dry sand work.

I was also informed that very successful work can be done by ramming the mold on its side in a flask, and after finishing it, stand it on end in a pit and ram it in. I have made many cylinders that way for small work but cannot see the advisability on heavy castings like a cylinder of four or five feet in the bore. The flask as well as the mold and cores would require to be exceptionally rigid to stand the handling, and a powerful crane would be required.

I was also told by a core maker that it is not always the mold or the metal which count.

The following letter from one of our readers on the Pacific Coast should be convincing that good work can be done by making the mold on end in dry sand, providing that proper care is taken.

"With reference to the article on the casting of cylinders, which appeared in your issue of May, Vol. XI., pages 122 and 123, you said you liked a good kicker. Well, here goes:

In this article, you take the stand that marine cylinders cannot be made in sand, but ought to be cast in loam. Well, I am going to say right here that you are all wrong.

Being a core-maker and in the employ of Mr. John Hedley of the Western Foundry, San Francisco, Calif., I wish to state that a large number of cylinders have been cast at this place in sand molds during the last four years, which is the time I have been employed here.

The cylinders have weighed from one to ten tons, and not one has ever been rejected, and all have stood the test required of them.

The core prints are rammed up in the drag, then the pattern is set on those prints. The patterns are usually made to mold up on end, with bosses and ribs loose, so that it may be drawn up out of sand. Sometimes, they are cheeked off but not always. These molds are rammed up strong with plenty of rods and vented well, with great care taken at all stages of the game not to let any old thing go by. In ramming up the mold, cast iron chills are used extensively in corners or wherever the molds are unusually thick, to prevent shrinkages and sponginess. The use of these chills will prevent leakages in the castings.

Mr. Hedley always gates his cylinders not far from the bottom of the mold if second ladle is used, that gate would be placed higher but never gated on bore. At this time of writing, we have just cast a cylinder weighing eight tons and have pursued the above methods.

Ramming up a cylinder is not the only requisite, but a good solid set of cores are very essential, with vents all clear. This, with a good mold, will come out all right. The mold will be well dried with a slow fire for two or three days, then setting the cores and pouring the mold.

For further information on this subject, you could call on Mr. Hedley, champion cylinder maker of the Pacific Coast.

William G. Leishman

This letter is certainly interesting, and the record of making cylinders for four years without losing one is still certainly the most interesting part of it. However, I always endeavor to have a loophole or avenue of escape, and I will try and wriggle out of this. In the first place it must not be overlooked that Mr. Hedley is a champion cylinder man, which fact I can vouch for, and secondly I don't think I should have been understood to say that cylinders could not be made in sand. What I said was: "Don't try to do this kind of work in a green sand mold, because the risk is too great. You might get a casting, but you might not. If you don't understand loam moulding, learn it; it is the simplest kind of moulding and the least likely to make trouble." Further on I said, "In molding a marine cylinder there is only one kind of a mold which is worthy of consideration, even though a complete pattern is provided, and this is a loam mold." Now, I don't know as I was so very far astray in this. A loam mold and a dry sand mold is practically the same thing. Whether we use Millville gravel or mix up some dope, the material used in either case is practically the same. With dry sand work a flask is used and the sand is tempered similar to molding sand, or a little more moist. The mold is made as with green sand, and when completed is blackwashed and baked for two or three days, when it is in reality a solid core.

With loam work the flask is omitted and a brick wall, following the design of the job is substituted. The loam mixture is wet to the constituency of mud because the brick wall absorbs the dampness and for the reason that it requires to be muddy in order to stick to the brick wall. When completed it is also blackwashed and baked. In baking a loam mold it is quite common to heat it to a high temperature in order to destroy what animal or vegetable matter was used as an opener, thus leaving it similar to a sponge, allowing easy escape of vent. With dry sand work this is not so essential as the mold is easily vented.

Although there are a lot of things to look after in getting a good cylinder, and as Mr. Leisham points out not the least of them is the core making. The condition of the metal and the manner of pouring also contribute to the success or failure of the casting. The article by Mr. Eastham on cylinder work, shows once again that Canadians have capabilities in this direction which have shown results equally as satisfactory as those achieved in shell production during the war.

The General Survey of Engines and Boilers

This Article Deals in a Descriptive Manner With the Work Necessary to Put a Ship's Engine Through Lloyd's or Board of Trade Survey

By T. H. FENNER

After the piston has been slacked from the rod and lifted out, a careful examination of the cylinder walls will be made. Very often a gauge made to the exact bore of the cylinder will be on hand, and this is tried at various points in the length of the bore. More often a telescope gauge is a hollow rod, with a movable rod sliding in the hollow, and pointed at each end. A set screw is provided to hold the gauge at any desired setting. The use of the gauge will shew if the cylinder is wearing out of round, or if it has been noted out of round at a previous examination, comparison of those measurements and the present ones are made. Of course, the only remedy for a cylinder worn badly out of truth is to re-bore it. Another thing to be looked at carefully while the piston is out, is at the top and bottom end of the piston stroke. It is at the bottom particularly that trouble is likely to occur. This trouble is the forming of a hard ridge just at the end of the stroke, which often causes a very unpleasant knock when the engine is running. Owing to the tendency of the piston to go lower in the cylinder as wear takes place, this ridge often becomes very hard and unyielding. The only thing to do is to chip it away with a hammer and chisel. In the intermediate and low-pressure cylinder, this is not a very difficult matter, as a man can get room to work by crouching down. In the high pressure cylinder it is a much more awkward job, which frequently entails a man hanging head downward in the cylinder and chipping as best he can for short intervals, with longer intervals of rest. The same thing occurs at the top end, but to a much less extent, owing to the influence of the counter bore.

While the piston is out the rings can be taken off, and the grooves thoroughly cleaned out. This is of course the high pressure piston we are referring to, and the rings are of the Ramsbottom type. The rings are removed by inserting a piece of hoop iron or a hack saw blade at the point where the ring is split, which is long enough to reach the full length of the piston. The hoop iron or saw blade is passed between the piston and ring and pulled around the circumference. When it is a little way round, another piece is introduced. In this way the ring is sprung from the grooves, and rests on the hoop iron, of which there will be three or four pieces. The ring can then be slid up over the hoop iron, and can be easily removed.

While the rings are off the piston they can be tried in the cylinder to see if they have sufficient spring to make a steam-tight joint. A piston ring should be capable of making a tight joint and at the same time offer the least resistance to motion, or in other words, the least friction. A ring, when tried in the cylinder, should bear all round, and at the same time be able to slide up and down with a very slight effort on the part of the fitter.

There is no use having a ring which presses against the cylinder walls with a great force. It will only cause wear, and probably not be as steam-tight as the ring that is an easy fit. The opening at the point where the ring is split should be enough to allow the ring to expand without the ends butting. This amount depends on the material of the ring, and the temperature of the steam. It will be in a high pressure cylinder of 24 to 30 inches diameter about 1-8 inch. One authority gives the rule that for each 12 inches diameter of cylinder 50-1000 inches opening should be allowed on cast-iron rings.

The rings should be also tried in the grooves for clearance vertically, that is between top and bottom of grooves. This should be sufficient to give clearance, and not enough to allow any play. Too much clearance between ring and groove in this direction will cause the piston to strike the ring with a slap at each end of the stroke, and will soon cause broken rings. Another point is to see that the rings are not worn too thin sideways. This will finish the work on the high pressure cylinder, and the work on the intermediate is very similar. The rings in the intermediate cylinder piston will always be carried on a junk ring, and may be either Ramsbottom type or a broad spring ring as shown in our illustration last month of an L.P. piston. The opening in the ring is about the same as in the high pressure, but on the intermediate and low pressure pistons there is a tongue piece fitted which serves to keep the joint steam tight, and affords a measure of support to the loose end. This tongue piece consists of a brass plate secured firmly to one end of the ring, and extending over the other for some distance. On this plate is a tongue or projection which fits into a slot on the end of the ring, thus making the ring practically continuous, while leaving it free to expand and contract.

There are quite a number of different types of spring rings for low pressure pistons, most of them being patented. The Lockwood and Carlisle is one of the best known of these. It is made in two sections, a top and bottom ring. Between these rings a special spring is placed which holds the rings up to the junk ring top and bottom and presses them out against the cylinder wall. Others are the Buckley and the Mather and Platt, among the best known. They have all the same object, which is to make the piston steam-tight with the least possible amount of fricton.

The intermediate piston is overhauled in much the same manner as the high pressure. The cover is removed, but it is not usually necessary to draw the piston on account of the junk ring carrying the rings if of the Ramsbottom type, and if of the broad type, the ring can be lifted after the junk ring is removed. Of course, if there is any reason to think that there is a ridge on the bottom, the piston will have to be drawn.

In the case of the low pressure piston, with its great size and weight, it is very unusual to remove it. There are both in the bottom and top covers of the cylinder manholes, which allow a man to enter either bottom or top of the piston to make an examination. Of course, when there is plenty of time, as in the case of a general overhaul, the top cover is lifted, and the junk ring removed, as also the spring ring. The cylinder under the piston will be examined by means of the lower manhole, and, if it is necessary to chip the ridge, a man can enter and do so. However, before he does, make sure that the low pressure crosshead holding up plate is stripped, and place a board at the turning engine marked, "Man under L. P. piston." The guard or holding-up plate ensures against the piston coming down without warning, and the notice at the turning gear will prevent anyone moving it till enquiries are made.

There is lots of room to work in the usual size of low pressure cylinder. To test the tightness of the ring, it should be placed in the cylinder clear of the piston. It should be tight enough to hold itself up, and at the same time be easily moved up and down by hand. A piston ring should never be too tight in the first place as the steam getting between ring and piston forces it out against the walls of the cylinder. Excessive tightness only causes wear and achieves no good object.

Next month we shall have something to say on valves, slide and piston.

Oil Resources of the British Empire

Paper Read by Sir John Cadman, K.C.M.G., Before the Royal Society of Arts, Contains Some Interesting Data.

THE enormous growth in the use of petroleum and petroleum products, stimulated in no small degree by the war, has led to a demand which at the moment threatens seriously to outstep the supply. Production, paralyzed during the war by lack of material for field development, has not kept pace with the requirements, and in consequence there is a world shortage, with the natural result of famine prices and an abnormal eagerness to explore new and untried fields.

It will be noted by reference to the map of the world that the continent of North America produces to-day over 85 per cent. of the world's output of crude oil. To this the United States at present produces in her own territory nearly 70 per cent. of the world's oil output, while if the quantity produced by the United States in Mexico is added, the total United States control in North America is at least 80 per cent. of the world's oil supply. It will be seen, further, that the British Empire produces only about 2½ per cent. of the world's supply, or if Persia may be said to be under British influence, about 4½ of the whole.

No Oil Exhaustion

It is only too true that the United States is herself consuming ever-increasing quantities of oil, and that her available exportable surplus of oil is dwindling. It has been said that the United States reserves of oil are becoming rapidly exhausted, but it is difficult to accept the very pessimistic reports which have lately been made public. Oil is not a commodity that can be easily measured, and no estimates, however conservative, can be strictly relied upon. We have seen in this country a parallel in the alarming rumors which predicted the early exhaustion of our coal supplies, and we have repeatedly seen how far from the truth the alarmist figures are.

Nevertheless, it is true that the greatest producer of oil to-day is absorbing more and more of her own supply, and it behooves us to look round to see, in the most friendly way, from where we are going to be served when the United States finds it difficult to supply us, and we, too, are calling for more and more of this vital product.

The figures for production for 1918 were as under:—

	Production, 1918 Tons
United Kingdom	250,000
Canada	40,000
Trinidad	300,000
India	1,150,000
Egypt	250,000
Australia, New Zealand	10,000
Sarawak	80,000
Total British Empire	2,080,000
Persia	1,500,000
World production	70,000,000

The following figures approximately show the present consumption and source of supply for the United Kingdom, although in 1918 the consumption was on the basis of 5½ million tons per annum.

Imports of all Petroleum Products to the United Kingdom:

Origin	Quantity (Tons).
United States of America	1,800,000
Mexico	500,000
Dutch East Indies	120,000
British India	60,000
British West India Islands	130,000
Persia	90,000
Total	2,700,000

Consumption in the United Kingdom:

Products	Quantity (Tons).
Crude oil	30,000
Kerosene	620,000
M.T. spirit	650,000
Lubricating oil	260,000
Gas oil	120,000
Fuel oil	1,020,000
Total	2,700,000

The consumption and production of petroleum products in the British Empire has been approximately:

	Consump.	Production
1912	4,212,000	1,421,000
1913	4,713,000	1,519,000
1914	5,467,000	1,563,000
1915	5,184,000	1,629,000
1916	6,128,000	1,655,000
1917	7,485,000	1,774,000
1918	9,038,000	2,078,000

1918	Production	Consump.
Great Britain	242,500	5,395,000
India	1,146,000	1,292,000
Canada	43,500	1,717,000
Australia	10,300	110,000
New Zealand	600	67,000
South Africa	....	54,000
Egypt	263,000	424,000
Trinidad	291,000	112,000

Being a liquid, natural petroleum is capable of migration within the pores of the containing rock, and of being concentrated within geological boundaries. It is owing to this characteristic that accumulations of crude petroleum on a commercial scale are possible. Given a spongy rock, bedded between two impervious strata, you can readily imagine that oil would slowly percolate by gravity into the lowest parts of the sponge. Doubtless, this is what would happen were it not that these porous zones are also filled with water, so that instead of the oil finding its way to the lower reaches, it flows on top of the water, oil being lighter than yater, and becomes concentrated or trapped into the upper reaches of whatever space is available. The form of this space depends upon the geological structures; anti-clinal or saddleback folding being the most common form.

Oil so accumulated is usually under pressure, either hydrostatic or gaseous, from which it may be released in the form of flowing wells or spouters when the containing stratum is pierced by a borehole.

It is not infrequent that surface indications of oil exist along the outcrops, and these indications, such as seepages of gas and oil, mud volcanoes, oil-stained sands, etc., when properly examined, may give useful data as to the potential oil-bearing value of the underlying structures.

After test wells have proved the existence of these underground supplies of oil, systematic drilling is proceeded with, the distance apart of the oil wells being governed by many factors, such as porosity and thickness of the oil beds.

Transport

When oil comes out of the wells, it is usually run through pipes into storage tanks. The commercial production of oil is dependent upon transportation, which is in most cases accomplished by means of pipe lines, tank ships, and tank cars. The storage tanks, which are situated in the oilfields, and are sometimes called tank farms, are generally connected with the gathering lines (about 2 ins. in diameter) of the pipe line system, through which the oil is conveyed to large storage tanks situated near enormous pumping plants. These draw the oil from the storage reservoirs and drive it under pressure into the main pipe lines (varying from 8 ins. to 12 ins. in diameter); and through these main pipe lines the oil is transported hundreds of miles, intermediate pumping stations being usually placed at distances of 30 to 60 miles along the main pipe lines. In the United States there are over 100,000 miles of main pipe lines, and they transport approximately 100,000 barrels of crude oil per day with greater facility and at lower freight rates than the oil could be shipped on the railways. The question of pipe lines is a very important matter, because even a producing oil well is of no commercial value

Continued on page 181

Eastern and Western Canada Marine Activities

JULY CORRESPONDENCE

BRITISH COLUMBIA

LATE reductions with a view to strengthen the position of Pacific Coast ports in competition with the Atlantic seaboard and gulf ports were agreed upon at the first annual conference of the Pacific Coast oriental tariff bureau, held in Vancouver recently. The new rates apply to trans-Pacific trade in certain essential commodities. Practically all important Pacific coast cities were represented at the conference.

In an attempt to obtain a slice of the trans-Pacific cotton carrying business a rate of $1.25 and $1 per hundredweight was set for cotton in standard and high density bales respectively. This is fifty cents under the rate from the Gulf of Mexico ports, and compensates for the shorter rail haul enjoyed by them. The new rate goes into effect August 1. The rates on steel for the Pacific coast to the Orient will be cut from $12 to $11 per ton as a result of the deliberations of the conference, this making the total rate overland to the Pacific Coast and thence to the Orient equal to the all-water rate from New York. The biggest cut is shown in the lumber trade, the rate being slashed from $35 to $25.

A cut in the automobile rate was also recommended, and will be decided upon later. It is urged that the present rates of $12 and $14.50 for pleasure cars and commercial vehicles respectively be reduced to $10 flat. The $15 rate on canned goods, which particularly affects Pacific coast canners, was allowed to stand, but the salt herring rate will be further discussed by representatives of the northern lines, who will meet shortly in Seattle. General merchandise was not changed and stands at $16, as will also the $10 rate on flour, recently set with a view to boost business with the Orient.

Official notification of the acceptance of the tender of Grant & McDonald for the first contract on the Ballantyne pier, Vancouver, has been made by the harbor board. The figure was $531,121.50 and covers excavation and filling. The length of time for completion of the work is set at between ten and twelve months. Immediately this is completed construction of the concrete pier will be started. The total cost of the structure will approximate $3,000,000.

When the Canadian Winner, recently launched in Victoria, is completed, the Canadian Government will have five steamships on the Australian run, according to B. C. Keeley, general agent of the Canadian Government Mercantile Marine, Ltd., on this coast. He announces that a service will be started between British Columbia, China and India, and a government official is already on the ground in India making preliminary arrangements. It is planned to place seven ships on this run.

Probably more as a result of the depression of the freight market than anything else Japanese interests have embraced the noved practice of dividing profits between ship owners and charterers. In such cases, a charter contract is concluded at the current rate with the provision that the steamer chartered shall be operated on the joint account of the owner and the charterer. Suppose a steamer is chartered at $15 for the North American service; whether the freight receipts of the charterer exceed or fall short of the total expenses, including charter money, the excess or deficit is to be equally shared by the ship-owner and the charterer. For such charter contracts the current rates are ostensibly charged, but it is understood that the actual rates paid are lower.

The increased subsidy asked from the Canadian Government by the Pacific Steamship Company has been refused. In announcing its decision the Government calls attention to the fact that abolition of compulsory pilotage, as recently agreed upon, will mean the saving of at least $3,000 annually to the company.

The auxiliary powered schooner Iskum, recently purchased from the Clayoquot Cannery, Victoria, by the Siberian Commercial & Trading Company, of Seattle, is now being sheathed and otherwise strengthened for bucking ice flows in the Arctic circle preparatory to a long cruise to northern trading posts in Siberia and Alaska. The boat is being refitted at the King & Winge marine plant, West Seattle.

The American wooden steamer Adria was fined $400 by Victoria customs authorities recently for breach of the port regulations. Dutiable equipment in the shape of a searchlight standard was landed in Victoria and supplies taken aboard before the ship entered at the customs house as required by law. The vessel was bound from Genoa Bay for Capetown with a cargo of lumber.

Advices received in Victoria indicate that the tonnage owned in Japan up to the end of March comprised 786 ships, aggregating 2,578,727 tons gross, excluding vessels of less than 1,000 tons. The firms or individuals owning these ships numbered 186 in Japan, 18 in Kwantung, six in Korea and two in Formosa. The largest Japanese owner is the Nippon Yusen Kaisha, followed by the Osaka Shoshen Kaisha, Kokusai Kaisha and the Toyo Kisen Kaisha in order named. The N. Y. K. controls 97 ships, aggregating 462,185 tons gross; the O. S. K., 79 ships, of 318,603 tons gross; the K. K. K., 53 ships, of 284,676 tons gross, and the T. K. K., 10 ships of 90,199 tons.

The steamship Makura, of the Canadian Australian Royal Mail Line, has been withdrawn from service while her boilers are being converted into oil consumers at the Bethlehem Steel plant, San Francisco.

The Vancouver branch of the International Longshoremen's Association has given notice to the coast steamship companies of the abrogation of the present agreement on wages and conditions of work in handling freight. The notice is for thirty days, as provided for in the agreement under which the longshoremen are working. The present rate is 80 cents and $1.10 an hour, straight time and overtime, and the men are asking for 90 cents and $1.25, or practically the same rates as the Prince Rupert dockworkers are striking for at the present time. The question will probably go to arbitration.

Victoria launched its largest steel ship June 29, when the Canadian Winner, 8,100 tons, was sent afloat from the Harbor Marine Company's plant in the inner harbor. The engine units have been delivered from the Toronto engineering firm of John Inglis & Sons. The Canadian Winner will shortly load cargo for Australia. In addition to its regular steel shipbuilding programme, the Harbor Marine Company will shortly commence construction of a steel car ferry for the Canadian Pacific Railway for delivery this fall.

F. W. Peters, general superintendent of the C. P. R. for British Columbia, offered the Waterfront Freight Handlers Association members a monthly wage of $115 for men of three years' experience at a session of the arbitration board which met to settle the wage dispute between the association and the C. P. R. The offer was refused by representatives of the association.

Net profits of the Nippon Yusen Kaisha for the six months ending March, 1920, amounted to $8,498,000, a decrease of $798,000 compared with figures covering the previous six months' term, ac-

cording to advices received here. The company announced a dividend of 40 per cent., and explained the reduction from 50 per cent. was due to the necessity of making provision for the future.

Announcement has been made at Ottawa that there are sufficient foreign orders on hand to keep Canadian shipbuilding plants engaged for two years. The national government's bonus system has put the Canadian yards in line to secure and carry through contracts for steel ships. Under recently-enacted legislation the minister of finance may be authorized by the Cabinet to indorse promissory notes drawn by the purchaser in favor of the shipbuilder for 50 per cent. of the purchase price in cases where the remaining half of the cost has been provided for. This applies to vessels of more than 3,000 tons and they are to be mortgaged to the Government for the full amount of the notes indorsed and registered in Canada without right of transfer until the mortgage has been cleared off. The general belief among Pacific coast shipbuilders is that the bonus system will stimulate the industry considerably, and they expect to share in the developments. French interests are said to be preparing to place an order for five large steel steamships with Canadian yards, and it is reported that capital representing the same country is likely to be invested in Canadian-built steel ships to the extent of $40,000,000 before the programme now contemplated is carried out.

There is talk of new contracts from the Belgian and Italian governments, but nothing definite has been announced so far. In the meantime, the Belgian Government has cancelled before delivery an order for six five-masted schooners to be constructed by the Lyall Shipbuilding Company, Vancouver. Judgment was signed in the Supreme Court a few days ago for $1,343,015.57 in favor of the Lyall company against Raymond Van Hemelryck, agent of the Belgian Government. It is the largest sum for which judgment has ever been given in British Columbia.

Definite arrangements have been made with the United States Shipping Board for the assignment to the Pacific Steamship Company (Admiral Line) of the steamships Wenatchee and Keystone State, the first two of the Shipping Board passenger and freight vessels allocated to the Pacific coast to be completed for operation in the trans-Pacific service between Victoria, Seattle and ports in the Orient. The Wenatchee will be ready for delivery to the Admiral Line early in November. The next two vessels to be completed will be allotted to the Pacific Mail Steamships Company and the balance of shipping distributed between the two transportation companies as fast as the ships are completed. According to announcement of Vice-President and General Manager A. F. Haines, of the Pacific Steamship Company, the line will secure a total of six vessels. Four will be operated from Seattle and Victoria to Nagasaki Kobe Yokohama. The other two will be operated from Seattle and Victoria to Vladivostok, Shanghai, Dairen and Tsingtau, returning via the same route. The steamships Wenatchee and Keystone State have a deadweight tonnage of 12,600, length of 535 feet, and are of the flush deck type. They are oil-driven and make an average speed of seventeen knots per hour. The vessels are provided with accomodation for 249 first class passengers, and 300 second-class passengers.

Contract for the ocean and fisheries dock extension at Prince Rupert has been let to Grant Smith & Company & Magoffin, Ltd., under the firm of Grant, Smith & McDonnell, Ltd., the firm has carried out important works in British Columbia, including the new ocean docks at Victoria.

Montreal Notes

Owing to the recent strike of wireless operators in Great Britain the sailing vessels during the latter part of June was slightly interfered with, but the trouble was of short duration and little effect was noticed on this side of the Atlantic.

The Century Coal Company's barge John Gaskin, which was laden with coal for the Mount Royal Textile plant, sank in the Lachine Canal on July 16, but in a position that does not seriously interfere with canal traffic. Salvage operations are now progressing.

The Department of Marine and Fisheries are contemplating the erection of a lighthouse on Bloody Island in the Richelieu River. This island is near the boundary line, and a lighthouse at this point would be a great improvement. Tenders are being asked for, and these must be in by August 21.

Considerable effort is being made at the present time by various interior waterways transportation companies to revive barge traffic as an aid to the scarcity of cars for railroad freight purposes. Increased quantities of material that does not need packing, is now being transported by means of barges operating on rivers and canals.

The Nascopie, of the Hudson Bay Company, which has been in port here for nearly two weeks, sailed recently on her trip to the far north. The Eskimo, Ouangwak, who was captured after a chase of nearly two thousand miles by officers of the R.C.M.P., will be a passenger on board, he being taken back to his native village to be tried on a charge of murder.

What might be likened to a partial return to war conditions, was given to the people of Quebec recently, when the vessel Valencia sailed from that port with a party of about 700 Czecho-Slovak soldiers that have been in training for some time at Valcartier Camp. The vessel will sail direct to Hamburg. Two similar units will sail for the same port from Halifax in the near future.

Action has been taken by the Dominion Government for the prevention of further flooding as a consequence to the overflow of the River St. Pierre, on the Island of Montreal. Plans have been prepared for the construction of a flood gate that will permit the surplus water to flow directly into the Lachine Canal. The syphon that carries the water of the river under the canal is not adequate for flood periods, and it is expected that the flood gates will eliminate future re-prepared for the construction of a flood petition of flooding in this district.

The serious nature of the coal situation has necessitated the Government taking action to conserve available supply. Orders have been issued to the effect that future bunkering of ocean vessels at Montreal with American coal will not be permitted, and in the future these steamers will require to take on coal that has been mined in Canada. This action was deemed necessary in order to provide better distribution of United States coal to industrial plants in this district. Ocean vessels will now be coaled at Gulf or Atlantic ports.

After being on the rocks near the mouth of the Saguenay River for nearly seven months, The C. G. M. M. steamer "Canadian Recruit" has finally been floated. The vessel was released on the night of the 17th of July and taken into Tadousac Bay and safely anchored. The remainder of the cargo will be unloaded, and following temporary repairs she will proceed to Quebec for complete overhauling. The salvage operations were successfully carried out by the Canadian Salvage Company under the supervision of Lieut.-Commander Wotherspon, of New York.

The contemplated encircling of the globe by the vessels of the Canadian Government Merchant Marine will, very shortly, be an accomplished fact. The inauguration of a service between Vancouver and the Far East in the near future will complete the belt that has been the goal of the National service. The Atlantic and the Pacific services will not exactly meet at the one port but they will converge within the Indian Empire, the Pacific route touching at Calcutta and Rangoon, while the Atlantic service will touch at Bombay, and both will call at Colombo.

No little inconvenience has been experienced here recently by some of the shipping companies, through the desertion of seamen from many of the vessels arriving at the port. Officials of the Shipping Federation, in co-operation with the port authorities, are taking ac-

Continued on page 181

Proposed Network of Wireless Communication

This Plan, as Proposed by the Marconi Wireless Telegraph Company to the British Government, is Hoped to Relieve the Abnormal Congested Condition of Submarine Cable Service

By J. H. RODGERS

THE proposed network of wireless communication covered by the plan submitted by Marconi's Wireless Telegraph Company to the British Government, would appear to provide the much desired Imperial chain, and as such it is hoped the scheme will be approved and adopted, either in its entirety or with some slight modifications, where necessary changes may seem advisable for the best interests of the system and the various countries that it will serve.

Realizing the abnormal congested conditions of submarine cable service, the Marconi Company has developed and perfected a plan that will not only give relief to existing systems, but will eventually prove of inestimable value to Great Britain, the overseas Dominions, and outlying British colonies. The late war has shown the imperative need of direct and uninterrupted communication between governments and operating field forces, and in no instance has wireless been equalled for reliable and effective service. The wireless mthod does not give the enemy the opportunity of severing communication, and therefore establishes an independent and effective means of creating a network of rapid communication, capable of embracing, not only all British territory, but also those equally important units of the Empire: ships at sea.

The terms upon which the proposal is submitted may be stated, briefly, as follows: The Company agrees to bear the entire cost of construction, maintenance, and operation of the complete network of wireless system, and pay a sum equal to 25 per cent. of the net profits of each station or stations to the Government in whose territory such stations are located.

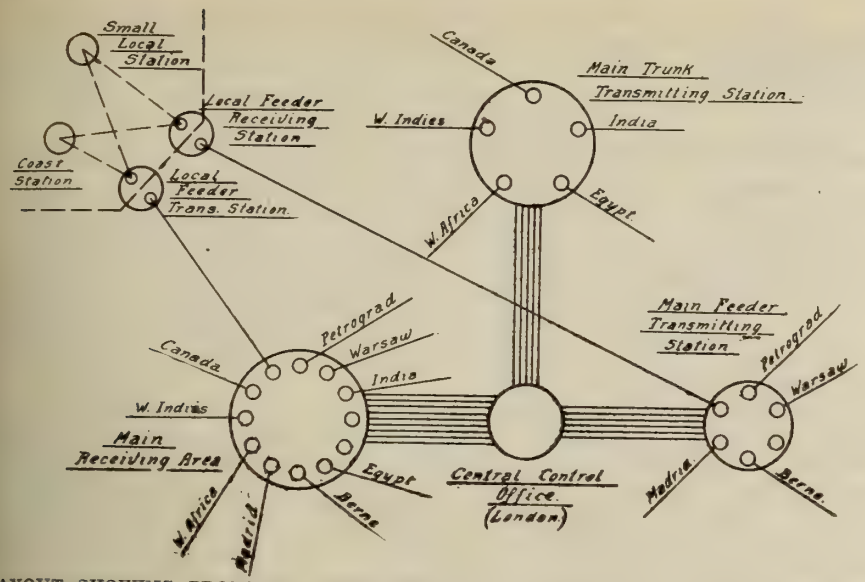
On the expiration of thirty years of service of any portion of the network, the system affected may become, if so desired, the property of the Government concerned, free of any payment. Special terms are provided should the Government, before the expiration of the thirty years, desire to acquire the system. The Government will have the right to take over the control of the stations during any period of war or national emergency, under arrangements agreed upon between the Company and the military authorities of the Government.

The proposal requires that the Government concerned issue all requisite licenses during the term of agreement, and grant every facility for the acquisition of sites, and that the Government construct and maintain the necessary underground and overhead cable systems that would be required for the telephonic and telegraphic feeder services. Special provision is made in the proposal to take care of the world trade in general, but the fundamental principle of Imperial preference is the keynote of the system.

The construction of the network would call for the erection of one or more main trunk stations in each country, for the carrying on of communications over long distances. In a country which forms a terminal of more than one route, and would necessitate a trunk station for each line of communication, the trunk stations would be grouped as close together as avoidance of mutual induction would allow, so as to maintain only one trunk transmitting area in any country. These areas would also include smaller transmitting stations, which, in turn, would be grouped to form a main feeder transmitting area. The receiving areas for the various services would be similarly arranged for economical and efficient service. The entire network would be under the control of a central office situated in a convenient telegraph centre of the country, with the transmitting and receiving areas located as nearby as economic condition would permit.

In proposing a network of this character, the Company has in mind, not only the commercial value of the enterprise, but the strategic value as well. As range is not restricted to definite distances, the choice of sites would be a

MAP SHOWING PROPOSED TRUNK ROUTES.



LAYOUT SHOWING PROPOSED ARRANGEMENT OF STATIONS AND THEIR CONTROL.

very important factor, and selection of location would be decided by joint conference between the Company's engineers and officers of the various fighting forces of each country.

The proposed main trunk routes are shown on the map, the necessary number of main trunk stations for this tentative network being twenty-six, five of which would be located in England. Two of the twenty-six would be located at Montreal, and two others at Vancouver, with feeder stations for Western and Eastern communication.

While the system of network has been developed on the best experience of wireless engineers, the final details and modifications, if any, would be agreed upon between engineers of the Marconi Company and representatives of the different countries. While the primary object of the proposal is to advance the commercial interests of the Empire, the future possibilities of war have been given due consideration, and with this in view, the personnel of such a network would become members of naval or military reserve forces, and capable of immediate mobilization in ranks comparable with the position they hold at their different stations.

The advantages of such an Imperial scheme of communication cannot be overestimated and it is hoped that the cooperation of the various Governments will enable the proposed network to become an integral part of British enterprise.

OIL RESOURCES OF THE BRITISH EMPIRE

(Continued from page 177)

unless it is possible economically by means of convenient transportation to send the oil to market.

Crude oil, when obtained, is subjected to refining processes, and by fractional distillation the various grades of oil known in commerce are secured. These vary from lubricating oil and grease to fuel oil and petroleum.

EASTERN AND WESTERN CANADA

Continued from page 179

tive steps to put a stop to this practice. It has been decided that in the future all such cases will be prosecuted and that a demand will be made for the full penalties of the law. One of the reasons advanced by deserting seamen is that they are paid considerably more money on American-owned vessels than on those of Canada or Great Britain.

The proposed plan of Empire wireless communication submitted by the Marconi Wireless Company to the British Government, has not been accepted in its entirety owing to the prohibitive cost of the installations. A plan that is a considerable modification from that proposed by the Marconi Company has been decided on by the Imperial Wireless Telegraphy Committee, and this plan will incorporate two wireless chains, one to Australia and the other to South Africa, both provided with intermediate stations. Similar communication will likewise be established with Canada but a conference will first be held to determine the approximate cost. This is expected to be in the vicinity of $6,000,000.

Following the action of the Government in providing aid to Canadian shipbuilding, the Canadian Association of Shipbuilders and Engineers are making an organized effort to secure shipbuilding contracts from several foreign countries. The French Government, who are urgently in need of many vessels, have been approached, and hopes are entertained that good contracts will be obtained, not alone in France, but also in other countries. Captain Gerrard, the secretary of the association, in speaking of the work, made the following statement: "I feel confident that those who are interested in the shipbuilding industry may now feel assured that it has come to stay. Our association is devoted to the interests of the shipbuilders, and will endeavor in every way to secure orders not only from the French but from other Governments that are in need of additional shipping. I know that the shipbuilders and marine engineering firms throughout the country, on whose behalf we have labored so strenuously during the past year, do appreciate all that we have accomplished, and we, as an organization, are optimistic as to the future."

TRADE NOTICES AND CATALOGUES

The George Stratford Oakum Co., Jersey City, N.Y., have issued a very well got up catalogue, or rather booklet, dealing with oakum and its kindred products and their uses. A history and description of the firm's organization is given, and the company is said to be the largest oakum plant in the world. The story of their connection with the war's demands is told by A. C. Stratford the president of the company. The rest of the booklet is devoted to a description of the various brands of oakum and their uses, as well as those of related products.

We have received a very handsomely bound and printed catalogue of John Birch & Co., Ltd., 2 London Wall Buildings, London, E.C.2, entitled, Dockyard Machinery. Messrs. John Birch & Co. have lately been entrusted with the overseas agency of the famous firm of Wm. Beardmore & Co., Glasgow. This catalogue is primarily printed for circulation abroad, and contains particulars and illustrations of many different types of ocean going, coasting and shallow draft vessels, cargo and passenger. Tugboats, dredges, and lighters are also given a place. Practically every type of marine accessory and fitting is illustrated and described, including winches, steering gears, compasses, etc.

The Worthington Pump and Machinery Corporation announce the purchase from the Platt Iron Works, Dayton, Ohio, of their drawings, patterns, jigs, templates, etc., including goodwill and name on the following lines: Oil Mill machinery, hydraulic turbine and water wheel lines, feed water heaters, and high pressure air compressors.

The Wellman-Seaver-Morgan Co. of Cleveland, Ohio, have issued a handsome catalogue dealing with their W. S. M. special cranes. These include pontoon cranes, sock cranes, shipbuilding cranes, concrete handling, and special purpose cranes. All these types are illustrated by photographs and line drawings, and a short description is appended to each.

There recently cleared from Glasgow for the River Plate a notable vessel, which was built in 1866. Originally a steamer, she was converted into a sailing vessel. She was, and is, a crack sailor, and has some very fine runs to her credit. She was built by the Napiers of Glasgow, and is now owned by Norwegians. Her name is the "Lancing," and she is a moving tribute to the excellency of those old-time workmen.

MARINE ENGINEERING

AND

Canadian Merchant Service Guild Review

A monthly journal dealing with the progress and development of Merchant and Naval Marine Engineering, Shipbuilding, the building of Harbors and Docks, and containing a record of the latest and best practice throughout the Sea-going World.

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The Jones Bill

OPINIONS of the new legislation for building up and nourishing the new American marine are freely quoted in the British press. One paper alludes to it as the "most drastic legislation" ever passed. The "Syren and Shipping," probably the most influential shipping journal in England, in their June 30th issue, uses almost the same words as we did in our editorial of last issue, entitled "Artificial Feeding." The "Syren and Shipping" says: "If, however, she (U.S.) thinks that the way to obtain that end (marine supremacy) is to discriminate against foreign shipping, she will certainly find that she has started a boomerang that, in due course of time, will return and give her a nasty jar." The Syren also thinks that the final result of the legislation will be to penalize the United States exporter, as operating costs are bound to be higher on American ships than those of other countries. It is also pointed out that there will be great difficulty in manning these ships, owing to the lack of interest in maritime matters by the general population of the States. An instance is given of a U. S. vessel bought on the instalment plan, which after a year's trading at top freight rates returned only 3½% profit on the investment. The Syren takes the view that the problem to be met by the United States merchant marine is a psychological one, and that its solution will be watched with great interest by Great Britain.

The "Liverpool Journal of Commerce," another highly influential paper in maritime circles, takes the view that the bill is a decided menace to the shipping of all other countries. The Journal of Commerce thinks the legislation the most drastic ever enacted, and that it foreshadows a struggle among the merchant marines of the world, of an unparalleled character. It points out also that retaliatory measures could, and would, be taken, if necessary, but prefers to believe that some of the clauses of the Jones Act will remain in abeyance, and "that it is not intended to put into force measures which, in the long run, would be calculated to inflict a serious blow at U. S. shipping and prevent it ever assuming that high position as an independent and virile industry which alone can enable it to take the permanent high place to which it aspires."

The general view taken is that no one can find fault with the U. S. having a merchant marine, but that they are not taking the best means of achieving their object. The mere possessing of ships does not ensure maritime greatness, and a huge fleet of ships which cannot be operated on a commercially profitable scale is a good deal more of liability than an asset. The halcyon days of high freights and big profits are passing, and the time is coming when competition will be of the keenest. In that day we confidently expect the British shipowner will keep his end up as he has always done, without fear or favor, and without the help of any paternal legislation.

Some Facts About Profits

THERE has been much wild talk about the fabulous profits made by the big shipping companies during the war. On the occasion of the trial run of the "Olympic" after her re-conditioning and conversion to oil burning, some interesting remarks were made by Mr. Harold A. Sanderson, the chairman of the White Star Line. He referred to the "Olympic" as the "one ewe lamb" of the fleet, and said it would be many years before they could add another to their fleet. They would instead build ships of smaller dimensions and more moderate speeds, which would provide all the comfort required by business men on their trips, but without the standard of million-airedom arrived at prior to the war. Speaking of the vessels lost during the war, and their replacement at present day costs, he made the following statement: "If the White Star Line had allowed all their earnings to accumulate since the war began, and paid no dividends; if to this sum they had added all the payments received from the Government for services, and if they had included all money received for insurance, then the grand total would not have enabled them to replace the vessels they had lost and to restore their fleet to its pre-war position."

This statement coming from the source it does, shows more truthfully the position of the big English shipping companies, and the sacrifices they made during the war. New construction is at such a figure that the shipowner cannot attempt to duplicate his losses, but has to be content with a more modest programme. It is evident that for some years to come there will be no more striving for the blue ribbon of the Atlantic on the part of British shipowners. Under the circumstances, our neighbors to the south may feel inclined to go in for it.

Where Good Times Hinge

THE stock market has been having several convulsions and near-convulsions during the past few days.

Shivers have gone up and down the financial spine of speculators, and they have predicted blue ruin and bread lines.

Fortunately the bread and butter of the country does not depend on the scares and shivers of the stock market.

The coming and going of May 1st without an industrial upheaval has more to do with our good or bad times than all the shoutings and scares the stock market can boast.

PROGRESS IN NEW EQUIPMENT

There is Here Provided in Compact Form a Monthly Compendium of Shipbuilding and Marine Engineering Auxiliary Product Achievement

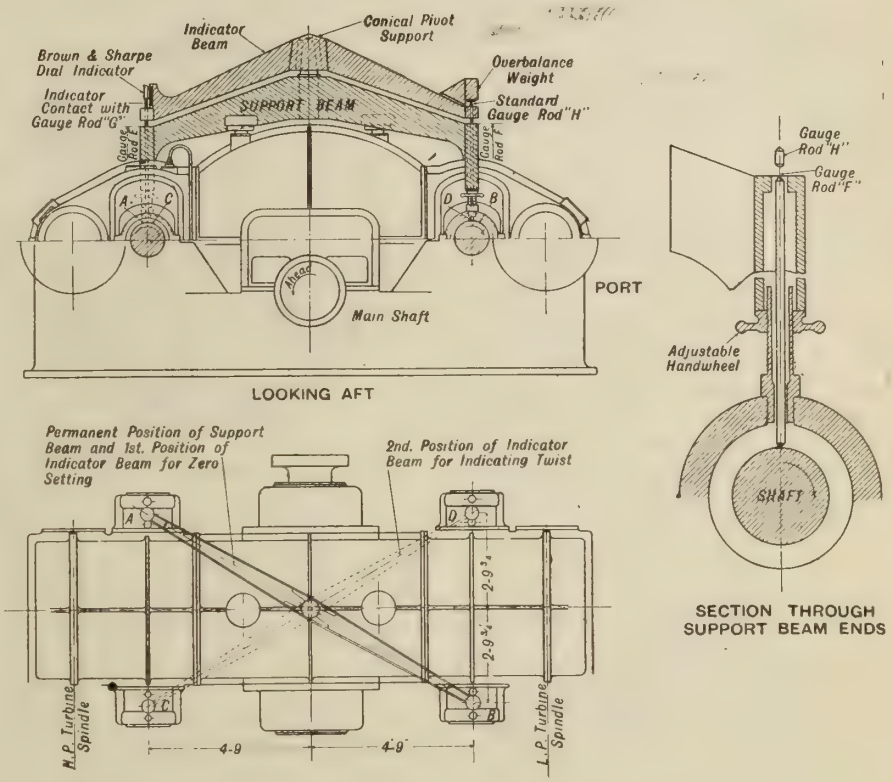
Alignment Gauge for Turbine Gearing

The Metropolitan Vickers Electrical Company, Ltd., Manchester, England, and Mr. William Eccles, have taken out a patent for an instrument to check the alignment of shafting and gears in geared turbines. The description is contained in the following:

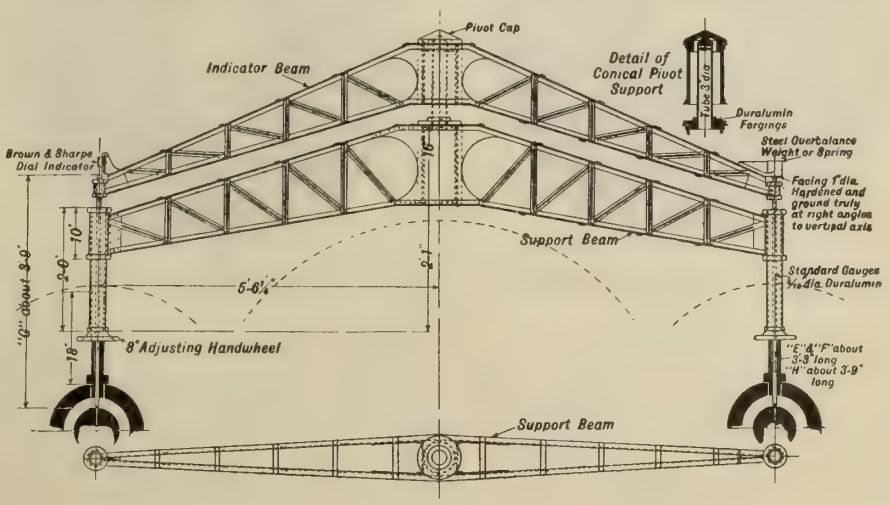
The apparatus is shown diagrammatically in the accompanying illustrations, the underlying principle of the design being that if the gear shafts are truly parallel then the point C—Figs. 1 and 2—must be in the plane defined by the points A, B and D.

Two beams, called the support beam and the indicator beam, are employed. The former rests upon adjustable hand wheels which operate upon hollow supports fixed into the bearing caps over the points A, B, as shown in the detailed sectional view—Fig. 3. By means of the hand wheels the support beam ends can be raised or lowered as desired, so that the top of the support beam end over the point B may be brought flush with the top of the gauge rod F, which passes through the hole in the end and rests on the top of the shaft at B. Similarly the gauge rod E—Fig. 1—fixes the vertical position of the end of the support beam above A, and in this manner the position of the conical pivot on top of the support beam is provisionally fixed for the purpose of the test relatively to the points A and B on the shafts. The gauge rods E and F are now taken out and replaced by gauge rods G, H respectively. The indicator beam is next placed on the conical pivot support so that the faced underside of the overbalance weight—see Fig. 1—rests on the top end of the gauge rod H. It will thus be evident that the indicator beam rests on the pivot support and the gauge rod H. At the other end of the indicator beam there is a Brown and Sharpe dial indicator graduated in thousandths of an inch. The contact knob of this dial indicator rests on the top of the gauge rod G, and in this way a reading is obtained. The dial is turned to make this reading zero.

The indicator beam is now swung round, so that the over-balance weight is above D, the facing under the weight resting upon the same gauge rod H, which has been placed in this second position. The indicator contact knob rests on the gauge rod G in its new position C, and if the indicator shows a zero reading the two shafts AC and DB are in the same plane. If a reading other than zero is obtained, then the plus or minus register will serve as a guide for checking up the gear case. Incidentally it may be remarked that for testing for co-planar alignment in the works the support beam might be dispensed with and the pivot support carried directly by the gear case top.



All the adjustments and settings described above are made when there is no load on the gearing, and when it is not in motion. When the gearing is running, in view of the fact that there is always a certain amount of clearance in the bearings, it is probable that the shaft journals will rise or fall in their bearings, and this condition would effect the zero setting above referred to. To obviate this trouble the gauge rods E and F are replaced through the support rod ends over A and B resepctively, and the supporting hand wheels are readjusted to bring the tops of the gauge rods flush as before. In this way the conical pivot support is brought back to the same position relatively to the points A and B, and the zero setting regained, while the indicator beam is still in the working position over C and D. With these points attended to the dial indicator may be read at any time. It should, of course, be understood that the diameters of the journals at A, C, D and B should be very carefully measured by a micrometer gauge, and when they are known, the necessary corrections of the



readings can be made for the relative positions of the shaft centre lines. The meter is shown applied to the high-speed pinions only, the assumption being that these pinions were in line when erected in the shops, and when all the necessary bearing adjustments required to make the low, intermediate, and high-speed shafts line up were made. In such circumstances, when the gearing is erected on board ship, it is only necessary to get the high-speed pinions true with each other, when the running shafts will also be in line, if the gear case is strong enough to resist cross bending. If, however, it be possible for the gear casing to spring or bend transversely, then it would be necessary to apply the meter between the low-speed shaft and each pinion.

It will be seen from Fig. 4 that the beams are of very light construction, and are built up of some light metal such as "duralumin." The weight of the indicator beam, if made of this metal, would be in the neighborhood of 25 lb., and that of the support beam 35 lb., so that the total load on each hand wheel would be about 30 lb.

"LETTGO" MECHANICAL OVERLOAD RELEASE

An effective "safety-first" mechanical device that will instantly disengage a drive when the load exceeds a predetermined point, has been developed by the Link-Belt Company, 910 S. Michigan Ave., Chicago, Ill. It is known as the "Lettgo" Mechanical Overload Release, and is especially adaptable for elevating, conveying, and power transmission machinery.

This release will automatically disengage the driving from the driven machinery if the load exceeds the fixed amount, thus allowing the driving

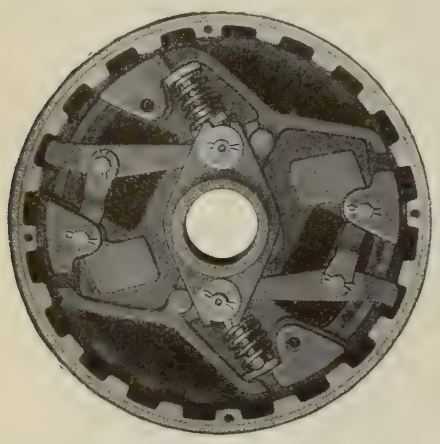


FIG. 1—"LETTGO" OVERLOAD RELEASE WITH PARTS IN POSITION FOR DRIVING.

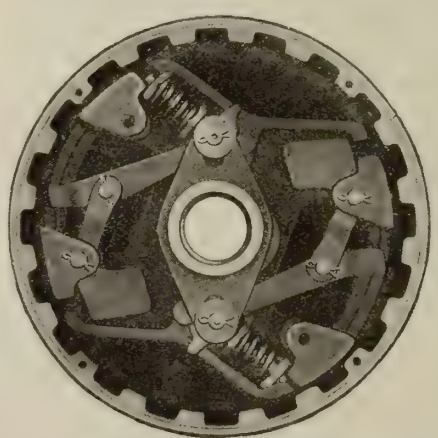


FIG. 2—THE OVERLOAD RELEASE WITH THE PARTS IN RELEASED POSITION.

motor or other source of power to run free and prevent damage, due to the inertia of the motor armature or other high-speed moving parts.

The construction of this device is such that it will release whether the load is gradually or suddenly applied, but it can be set so that it will not trip from jars or shocks.

It is symmetrical, and can be assembled to operate in either direction, and can be adjusted for tension, so that it will operate for any desired overload. The mechanism is entirely enclosed and

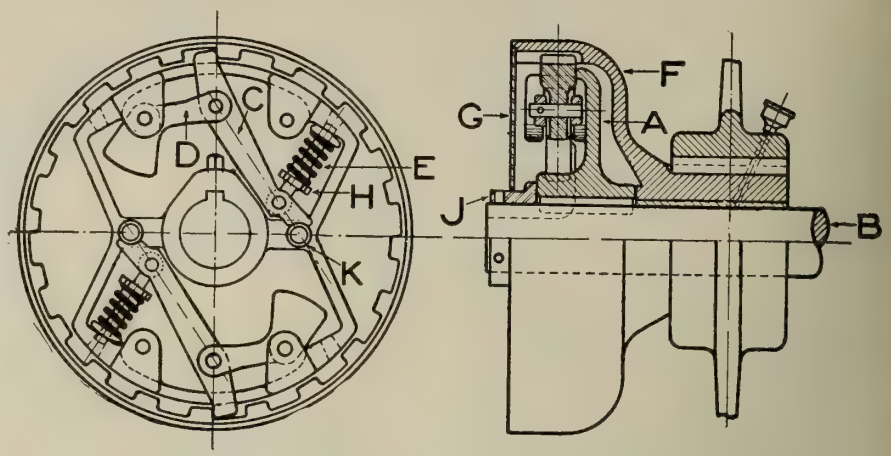


FIG. 3—DIAGRAMMIC VIEW SHOWING THE CONSTRUCTION OF THE DEVICE.

can be packed with grease for lubrication purposes.

Following is the action of the release:

The spider A, keyed to the shaft B, has triggers C pivotally mounted on the links D, with the ends engaging inside notches in the rim of the drum F, and rollers K.

The springs E, regulated to any desired pressure by the adjusting nuts H, hold the ends of the triggers on the rollers K, under normal conditions, but when the drive is over-stressed, the compression of the springs will permit the ends of the triggers to drop into the position shown in the enlarged section, releasing connection with the rim F, and allowing the driven machine to stop immediately.

To set the triggers again in the driving position, the collar J is provided with fingers that engage the pins on the lower ends of triggers C. By turning this collar with a spanner wrench, the triggers are moved to the original position, and the outer ends at the same time enter notches in the drum F, thus re-establishing the transmission connection. The cover G, fitting the end of the drum F, incloses and protects the entire mechanism. The hub of the drum F may be extended to receive a wheel or gear, and have a bushing for running loose on the shaft; or may be keyed directly to a separate shaft, thus forming a coupling device, in which either element may be the driver.

DIRECT-CURRENT SERIES-WOUND MOTORS

For severe intermittent varying speed service where heavy starting torque is required, such as for cranes and hoists, the Westinghouse Electric & Manufacturing Company has recently brought out the type "HK" direct-current, series-wound motors. These motors are especially designed for use where the load consists of a series of starts, stops and reversals, the motor being idle for only short periods of time.

These motors are of enclosed construction with small openings in the lower part for ventilation. Covered openings in the top half of the frame give access to the brushes and the commutator. The most prominent feature of this motor is its compact construction, giving small overall dimensions, light weight and great mechanical strength.

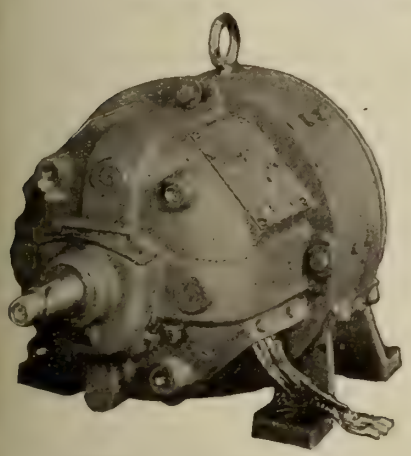
The motor has a forged open-hearth steel frame and solid forged-steel feet. The motors above three h.p. rating are equipped with commutating poles so that high momentary loads can be carried without series sparking, and long life of commutator and brushes thereby insured. All field coils are thoroughly insulated and impregnated. The brackets are strong and rigid, each complete with oil well and bearing housing. Oil ring lubrication is used. The brush holders are clamped to insulated rods mounted on the front bracket which are doweled in place. The position of the brushes is thereby fixed for both directions of rotation.

Armature coils are form-wound and thoroughly insulated and impregnated before being placed in the slots. A

blower is placed in the rotor which effectively ventilates both armature and field windings. This allows a smaller diameter armature to be used, resulting in low flywheel effect, consequently little energy is required to start and stop the motor, thereby reducing to a minimum, wear and tear on bearings and brakes.

Electrically-operated shoe-type brakes are supplied when ordered. They are bolted to the machined lugs on the motor bracket, making a compact unit of motor and brake. The brake is simple and rugged, and provision is made for adjusting for wear of parts.

The company states that the ability of any motor to do its daily work, as far as its temperature rise is concerned, is determined by the continuous rating it will carry at a safe temperature. A ventilated motor has a larger continuous rating than a non-ventilated motor of the same short time rating. A ventilated motor rated 7½ h.p., one-quarter



GENERAL VIEW OF MOTOR.

hour, has about 30 per cent. more continuous capacity than the non-ventilated motor rated 7½ h.p. one-half hour.

NEW MOTOR FUEL NOW USED IN NATAL

Report to Admiralty Says it Has Been Found Possible to Produce It in Large Quantities

London, July 1.—After a series of trials in motor boats, the British Admiralty has just made a confidential report on the far-reaching possibility of using a new motor fuel—"Natalie"—in naval vessels.

This substitute for gasoline which has been used successfully three years in Natal, South Africa, the fuel manager of an automobile association said to-day, is a mixture of alcohol and ether and other things, and is made cheaply in South Africa, where there are large tracts of waste vegetation, from which power alcohol can be extracted.

It is manufactured in some places as a by-product of the sugar industry.

Admiralty Court Reports

SS. "MANCHESTER DIVISION" STRANDING

In the matter of a formal investigation held in the Wreck Commissioner's Court, Montreal, P. Q., on June 24th, 1920, before Captain J. Blanchard Henry, Commissioner, assisted by Captain J. C. Caine and Captain C. J. Stuart, acting as Nautical Assessors, into the causes which led to the stranding of the S.S. "Manchester Division" in Quebec Harbor, on June 7th, 1920.

Hon. A. W. Atwater, K.C., appeared for the Shipping Federation of Canada; Mr. A. R. Holden, K.C., for the Quebec Harbor Commissioners; Mr. E. Lafleur, K.C., for the Master, and Mr. A. Chase-Casgrain, K.C., for the owners of the S.S. "Manchester Division."

The S.S. "Manchester Division," of Manchester, 6,026 tons gross, 3,774 tons net, 418′ length, 53′ 6″ beam, single screw, left Manchester on May 27th, 1920, fully manned and equipped, bound for Montreal, arriving in due course off Father Point, where Pilot J. A. Bernier boarded the ship, piloting her to Quebec.

On arrival off the harbor of Quebec on the morning of the 7th June, instructions were received to proceed to Berth 28, and the tugs "Belle" and "M. E. Hackett" took hold of bow and stern lines respectively, for the purpose of assisting the ship to make this berth, a brand new nine inch hawser being passed out to the tug "Belle" on the starboard bow, as she was then off that bow.

The ship approached the gas buoy indicating the southern end of the dredged channel, on a northwest northerly course, passing within 30 to 40 feet of same, this manoeuvre being adopted owing to the flood tide setting up to the break-water, though as after events showed, the tide did not have as much effect as the pilot anticipated.

It was within half an hour of high water, while the weather was bright and clear, with all objects visible but with wind and rain squalls developing.

After clearing the gas buoy, about 10 a.m., the head tug crossed to the port side to assist in pulling the ship in towards the berth. The ship's speed then was about two knots an hour. The hawser, which was leading from the starboard chock, was protected from the stem by a paunch mat placed there for that purpose.

Up to this time everything was proceeding according to the expectations of the pilot, no danger being apprehended, though the wind was now striking the ship on the port side: but at this moment the forward tow line parted about eight feet from the stem.

The engines were immediately put full speed ahead, and the helm kept hard-a-starboard, in the hope of getting the ship's head sufficiently to make the centre of the channel, while in the meantime every effort was being made to make fast the tow-line again; but to no avail, the ship apparently drifting on to the starboard bank under the effect of the wind, just about the time the tow line was made fast the second time.

It is stated that a period of three to four minutes elapsed from the time of the parting of the rope until the ship took the bank, and that the ship in this time covered a distance of 300 to 400 feet.

Every effort was made with the aid of all available assistance to float the ship immediately, but as the tide started ebbing very shortly no success was attained until the next day at 10.30 a.m., when the ship was floated with the help of tugs, after lightering some cargo and pumping out all water ballast.

The ship went into dry dock at Quebec, but was not found to be greatly damaged.

Finding

The Court is of opinion, after carefully considering the evidence submitted, that this casualty was due to the parting of a new nine-inch hawser leading from the starboard bow of the steamer to the tug "Belle".

There is nothing to indicate that any undue chafing of the rope was caused, as it was protected on the stem by a paunch mat placed there, while the testimony of the master of the tug "Belle" was to the effect that the rope parted well clear of the stem.

After the parting of the rope the only practical manoeuvre was thought of and acted upon by the master and pilot, in going full speed ahead with the helm hard-a-starboard in an endeavor to bring the ship's head around to port; but owing to the squally condition of the wind this manoeuvre could not be executed before she took the bank, and the vessel stranded beam on, striking so lightly that it was not perceptible to those on board.

The Court can give no reason for the parting of this rope except that there must have been some unknown defect.

The Court attributes no negligence for the stranding of the steamer to those in charge of her handling, and therefore exonerates both master and pilot from all blame.

The Court recommends that in future vessels going into this berth should be instructed to use a line from each bow.

Read in open court at Montreal this 25th day of June, 1920.

(Sgd.) J. Blanchard Henry,
Commissioner

Concurred in by

(Sgd.) John C. Caine,
(Sgd.) C. J. Stuart,
Assessors

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S.S. "QUEBEC" STRANDING

In the matter of a formal investigation held in Montreal, at the Wreck Commissioner's Court Room, on June 21st, 1920, by Captain L. A. Demers,

F.R.A.S., Dominion Wreck Commissioner, assisted by Captain Charles Lapierre and Captain C. J. Stuart, acting as Nautical Assessors, into the causes which led to the grounding of the S.S. "Quebec" on June 3rd, 1920, at a place near Three Rivers, in the river St. Lawrence.

Mr. A. R. Holden, K. C., assisted on behalf of the Canada Steamship Lines, Limited, owners of the S.S. "Quebec."

The master, Samuel Wilson McClennon, said the S.S. "Quebec" was a ship of 2,013 tons net, 3,498 tons gross, 311 in length, 64' beam, carrying a crew of 105, with a speed of 12 to 13 knots, drawing 7' 6" forward and 10' 6" aft.

This ship grounded whilst in charge of the pilot and mate, at about 12.31 a.m., June 3rd. She had been stopped for 24 minutes in order to await the departure of the S.S. "Saguenay," which was then at Three Rivers wharf. During and before the stop, there was a white smoke emanating from the pulp mills which prevented lights being seen. Whilst stopped, the vessel's head was canted towards the north. It is said there was a little current. After grounding some efforts were made to get her free; but to no avail. The master was called as soon as the vessel got into trouble. She was floated some days after with the help of tugs.

Report

The analysis of the evidence shows that when the vessel was stopped, and left to drift with the tide, for a matter of 24 minutes, no attempt was made on the part of the pilot or the chief officer, who was then on duty, to ascertain how the ship was drifting, and of her constantly altering position due to current, by any means whatever.

The pilot relied altogether on his old courses, admitting that the intervals of time between each place were somewhat changed owing to bad coal.

The pilot had a long experience without any accidents and acquired such a confidence in his work, courses and position, that he made sure that, notwithstanding the fact of this white fog, due to chemical fumes from the mills, had obscured the guiding lights, that his position was correct.

The first officer had no instructions and was under the belief that the pilot controlled everything, and therefore did not exercise his judgment as custodian of the ship whilst the master was asleep.

It has been amply proven that the escape of these fumes from the Wayagamack Mills interferes somewhat with navigation, depending on the direction of the wind.

This being a matter well known, it behove the pilot to exercise extra care in determining the position of his vessel frequently, whilst she was at the mercy of the current.

Finding

The Court having carefully reviewed and weighed the evidence adduced, finds that the pilot, Edward Gauvreau, erred through over-confidence in his courses, and that he is in default for not taking a cast of the lead occasionally to ascertain if his vessel was keeping in navigable waters. Being an unlicensed pilot the Court has no other option to deal with him than finding him at fault.

With regard to the first officer, he has shown a lack of knowledge as to his duties whilst in charge. The Court takes into consideration that he was a stranger in that service and had not received specific instructions as to the role he had to play in connection with the pilot and wheelsman. Hence the Court does only reprimand him severely and caution him to exercise better judgment in future and acquire a better conception of his duties and responsibilities as a first officer.

Rider

The Court is of opinion that in view of the evidence adduced the chemical fumes from the Wayagamack Mills played an important role in the grounding of the S.S. "Quebec," as it cast a mist over the surroundings, obliterating all lights at intervals, in view of which it is strongly urged and recommended that some action be taken in order to cause the elimination once for all of those fumes which, to the Court's knowledge, have been a nuiscance and a danger for some time past to the navigation of the river in the vicinity of Three Rivers.

Dated at Ottawa this 26th day of June, 1920.

(Sgd.) L. A. Demers,
Dominion Wreck Commissioner

Concurred in by

(Sgd.) Charles Lapierre,
(Sgd.) C. J. Stuart,
Assessors

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RE. S.S. "PICTON."

In the matter of a formal investigation held in the Wreck Commissioner's Court, Montreal, June 12th, 1920, before Captain L. A. Demers, F.R.S.A., Dominion Wreck Commissioner, assisted by Captain C. J. Stuart and Captain J. C. Caine, acting as Nautical Assessors, into the causes which led to the S.S. "Picton" striking Laurier Pier, Montreal harbor, on June 8th, 1920.

The complainants, The Montreal Harbor Commissioners, were unrepresented by counsel, but Mr. M. P. Fennell, Jr., the secretary, assisted.

Messrs. A. R. Holden, K.C., and R. C. Holden, appeared on behalf of the S.S. "Picton," while Mr. B. P. Raymond appeared on behalf of Messrs. Sincennes-McNaughton Company, Limited, owners of the tugs.

The S.S. "Picton" is a steel built, single screw vessel, 9 years old, of 3240 tons gross register, with triple expansion engines, of a speed of 8½ knots, carrying a crew of 36, including master and two duly certificated deck officers, and four engineers, two of whom are certificated. She is 382' in length, 52' beam.

On June 8th the vessel was being shifted from her berth at the head of Tarts Pier to Pier No. 8, in Montreal harbor, under the direction of Montreal Pilto Anthyme Perrault, with the assistance of two tugs, "MacSince" and "Mathilda." The weather at thet time was fine and clear, with a moderate breeze blowing.

The original intention was to shift at 11 a.m., but the engineer had advised that he would not have steam ready for that hour. At about 12 noon, the master was on the bridge with the pilot, an apprentice was at the wheel, with the chief and second officers at their stations fore and aft, and a tug at the bow and stern with lines out respectively. Though steam was not yet ready the stern lines were cast off, and the ship hung only by the bow rope, though both master and pilot deny giving orders to cast off stern lines, stating that as there were two tugs in attendance they did not consider it important.

The telegrauh was then put half speed astern, and the order answered from the engine room, and shortly after it was noticed that the head of the ship was closing an Lauriar Pier, and the telegraph was then put full speed ahead with a hard to port helm; but the ship struck the corner of Laurier Pier.

Report

An analysis of the evidence leads the Court to be of opinion that whilst the casting off of the stern lines may in some cases be trivial, in this case it proved to be a factor in the damage caused by the S.S. "Picton" to the Laurier Pier.

Owing to an eddy forming at the end of Tarts Pier, causing a flow inward, the moment the lines were cast off the stern of the vessel gradually left the wharf, till within 150' from the Laurier Pier. Meantime the bridge had been warned that the engines were not ready, but relying on the fact that two tugs were in attendance no attempt was made either by the master or pilot to secure the ship to the wharf pending the advice of the engineers that they were in readiness to respond to orders.

The inward flow or eddy was known to the pilot. The evidence is conflicting with respect to orders given to the tugs; but the Court accepts the version of the captains of the tugs "Mathilda" and MacSinco," that they had no orders, and that the "MacSinco" was, when towing the S.S. "Picton" astern, directing her efforts in the proper way, and in order to prevent the "Pcton" from drifting too rapidly towards Tarts Pier when within the current. Therefore, when hauling astern and gradually bringing the stern of the "Picton" out and up towards the current, the order full speed ahead was given by both Master and

Pilot, the effect of which was to bring the bow towards port, and without violence that part of the ship forward of the bridge on the port side, struck or grazed the corner of the Laurier Pier, causing certain damage with which the Court is not concerned.

It is the knowledge of the Court that in bringing a ship out of the basin, either the ship must be close, touching the Laurier Pier before any attempt is made to go astern, or she must be in the centre or to the eastward of the centre of the basin to permit any vessel of such length to clear when on the swing. In the position the "Picton" was the forward tug boat should have been ordered to be on the starboard side to check the swing of the ship when the current caught the stern whilst backing at half speed.

Hence, in view of the evidence the following finding is given.

Finding

The Court having carefully weighed the evidence adduced finds, for the reasons given in the analysis of evidence, that the damages done to the corner of the Laurier Pier, was caused through lack of specific orders to the tug boats from the pilot, Anthyme Perreault, who had allowed the "Picton" to approach the pier too closely before any attempt was made to leave the basin, and this was brought about through the stern line being cast off before the engines of the "Picton" were ready, and without orders from either pilot or master, in consequence of which the stern of the ship was permitted to drift from the wharf some 150 feet before any action was taken.

Hence the Court holds the pilot erred in not exercising proper judgment.

The Court therefore reprimands him and cautions him to be more careful in future.

The Court also cautions the master, Mathias Mathias, for the reason that as his engines were not ready it was his duty to see that his ship did not leave her berth before everything was in order. An order to pass a breast line ashore should have been given when it was found the stern lines had been cast off.

The Court finds that the tug boats "Mathilda" and "MacSinco" were not in any way to blame for this accident.

Read in open court at Montreal this 21st day of June, 1920.

L. A. Demers,
Dominion Wreck Commissioner.

Concurred in
(Sgd.) J. C. Caine,
Assessor.

* * *

Re. S.S. "Picton" and Tugs "Mathilda" and "MacSinco."

In reference to the attached finding of Wreck Commissioner in the above case, I regret to say I cannot agree with the last paragraph, exonerating the tugs.

I am of the opinion that although it is the duty of the tugs to obey the orders from ship in tow, I do not consider their duties end there. They should be able, owing to their daily experience in this locality, to anticipate the Pilot's orders and have such control of their tugs that in a case like this, where the vessel being shifted was not under control, had no steerage way and in a confined space, they should have realized the manner in which the vessel was being set, and been able to avoid the accident. For this reason I am of the opinion the tugs "Mathilda" and "MacSinco" are pointly responsible.

(Sgd.) C. J. Stuart,
Assessor

Captain L. A. Demers,
Wreck Commissioner,
Ottawa, Ont., June 15, 1920

MODERN TRAVEL SERVICE FOR MUSKOKA

Train and steamer having proved too slow for the fast moving citizenry of Toronto, a service by air between Toronto and Muskoka is being inaugurated. This is being managed by the Bishop Barker Aeroplane Co., and the service will be carried on by two hydro-aeroplanes. The first of these craft is already in Toronto, having been flown from New York by Colonel Barker. The boat or flying boat, as you may prefer,

The Bishop-Barker Co.'s Hydroplane

has engines of 379 H. P., with a wing span of 87 feet, and is capable of a speed of 87 miles per hour. The accommodation is sufficient for five passengers, exclusive of the pilot. The distance, by the course proposed, is about 145 miles, and passes over a chain of lakes. The distance it is expected will be covered in 2¼ hours, a great saving over the train time, to say nothing of the thrills to be enjoyed through such means of locomotion. The innovation should be a great success.

REVIEWS

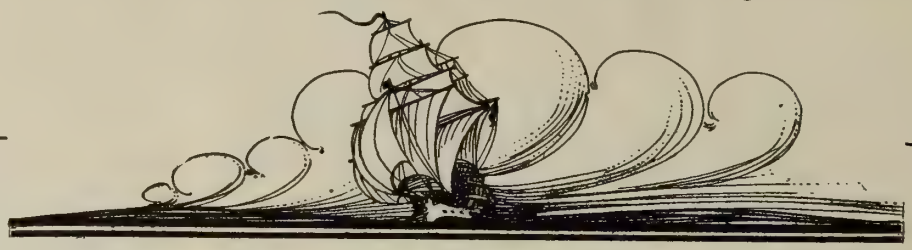
We have received a copy of a new book by Victor W. Page, M.S.A.E., with complete working drawings and building instructions by A. Clark Leitch, N. A., entitled Motor Boats and Boat Motors. This is the most complete work on this subject we have yet seen. It deals exhaustively with motor boats classification, construction and design, fittings, and operation. The part contributed by Mr. Leitch deals in detail with various types of motors, their necessary auxiliaries, and installation. A chapter is devoted to propelling devices, and another to the care and repair of motors. The concluding chapter is on seaplanes and flying boats, and is very complete in its treatment of this subject. The book is splendidly illustrated, and well indexed. The book has been written with a view specially to appeal to the many classes of motor boat owners, who generally have a very hazy idea of the construction and maintenance of their property, and to them it should have a strong appeal. It is at the same time a useful book for the amateur builder, and to anyone interested in this type of craft. The book is published by the Norman W. Henley Publishing Company, 2 West 45th Street, New York City. It contains over 500 pages, and is sold at $4.

The advance of the oil engined ship in the mercantile fleets of the world has necessitated a technical literature devoted to this branch of Marine Engineering. The latest periodical publication of this kind to join the ranks is "The Motor Ship" published by the Temple Press, 7 to 15 Rosebery Avenue, London, E.C. 1. We have the third issue of this paper before us, for the month of June, and can congratulate the publishers on the general get and editorial matter it contains. It is particularly well illustrated and contains some very good technical articles, besides descriptions of the latest motor ships. A couple of pages are devoted to notes and comments of general interest, and a couple more to news of the month with special reference to the oil fuel and motor ship situation. Single copies are one shilling. We wish the new journal, which has a definite value in its field, every success.

Another large English newspaper has decided on the publication of a weekly commercial review. This is the well-known Manchester Guardian, and the new weekly is called the "Manchester Guardian Commercial." It contains many valuable articles on the general aspect of the world's markets, their tendencies and the causes of same. Developments in engineering, etc., are also treated. Such a publication should be a very useful one to the Canadian business man.

What Goods *Must Stand* on the High Seas

By T. H. FENNER, Editor Marine Engineering



SINCE the galleys of the Phoenicians came over the seas to take tin from the mines of Ancient Britain, vessels and methods have improved, but the perils of the old ocean remain much the same. Science has provided us with stronger weapons to overcome the treachery of wind, sea and fog, but ships laden with valuable cargoes still leave port to be heard of no more, or to arrive battered wrecks, with cargoes water sodden, fit only for sale by auction to the hangers-on of commerce.

The day of the supercargo has passed, but it might be worth while in many cases for a manufacturer who is selling goods for export to far countries to send a representative for a voyage to see for himself what his goods have to go through before they arrive at their port of destination. He would come back with stronger impressions of the necessity for expert packing than the reading of a thousand articles would convey to him. Even when goods are crated and packed with the most meticulous care there are many ways in which they can be damaged during their voyage overseas, ways which the shipper has very little chance to prevent or control.

One of the most annoying sources of loss, and one which seems almost impossible to eradicate, is that of pilfering by longshoremen and others who contrive to find their way to the docks where ships are unloading. Sometimes this is aided and abetted by the crews of the ships themselves, and so serious has it become that shipowner and forwarding agents, together with underwriters, are getting together to find some effective means of combatting it. Of course the exporter of heavy machinery is not much bothered with this class of loss, but manufacturers of goods that are exported in packages are the victims. Such articles as boots, shoes, textile products, cigarettes and tobacco, which are readily hidden away, are favorites with the dockside robber. The packages may be rifled at the port of shipment while they are being loaded, as well as at the port of destination. Some ports are notorious for this class of thieving, while others having more efficient supervision by the dock police keep it within bounds. When the stealing is done on the dock side it is out of control of the ship's officers, but when it is done in the hold of the vessel it will depend on the calibre of the officer in charge of that hold how much can be got away with. If he is a man of long experience and some personal courage he can prevent a great deal, but if he is a young chap and susceptible to intimidation, it will be carried on almost openly.

The favorite method of ascertaining what class of goods is in a case, and of making it accessible at the same time, is to have it slip out of the slings when lowering. This will be done at a height just sufficient to burst the case open. If the packages are being lowered in a cargo net where it is not very convenient to slip them out, the signal to the winchman to stop lowering is delayed long enough to let the net reach the bottom of the hold with a good sharp bang, which does the trick very nicely. The broken case is then put over in a wing of the hold and left strictly alone for a while. Then an opportunity comes when the officer is in some other part of the hold to abstract a few pairs of boots or boxes of tobacco, suits of underclothes, or whatever it may contain, and these are rapidly distributed and cached till the time comes to get them ashore. If the officer who is looking after the loading happens to catch them, it will depend on his ability to handle men whether they are put back or not. While as a rule these men will not resort to violence, they can act and look ugly enough to get the average man to look the other way. The officer usually consoles himself with the thought that his business is only to see that the cargo is stowed properly, and it is up to the dock police to see that nothing gets out of the gates. There is considerable stealing done also at night time by men who come alongside in boats, clamber up the side by means of a handy rope, and abstract goods wholesale. They are usually aided by the fact that the nightwatchman is stationed at the side of the ship next the wharf to watch the gangway. The thieves are not only bold, but possess a certain sense of humor. The writer was in a ship lying in Genoa, a notorious port for thieving, and the skipper had made a vow he would get some of them as they had not been content with cargo but had been stealing the bo's'n's stores. The old man had spoken pretty freely of his intentions, and word had evidently reached some of the gentry ashore. The ship lay moored to a buoy at the bow and the stern on to the wharf, and a ladder was over the stern to give access to and from the ship. Just at noon one day, when practically all hands were on deck, the red ensign (affectionately known among sailors as the "blood and guts of Old England"), which floated lazily from the jack staff at the stern slowly disappeared, and just as the rush of angry men reached the poop, the communicating ladder was wafted away. Three brown-skinned rascals laughingly put our ladder up against the freight shed, mounted it, pulled it up after them, laid flag and ladder on the roof of the shed, and disappeared over the other side with a wave of the hand and a parting smile. It was many days before our skipper heard the last of that.

Just to show that ingenuity in thieving is not confined to any particular place, a case occurs to my mind that happened in Liverpool. This was not connected with cargo, but doubtless the perpetrators had gained experience in that field of endeavor. A large valve made of bronze and weighing about 600 pounds was to be sent ashore for repairs. Three men arrived at the dock with a hand cart, one from the ship owner's own repair shop, and stated they have come for the valve, which was promptly given to them, and pushed their cart with the valve on it out of the dock with the accustomed stately deliberateness of the British working man. It was never seen again, for by the time the hoax was discovered all traces of it had disappeared. It was so common a sight that no one took a second glance at the men, and they no doubt had a convenient foundry to dispose of it without loss of time.

Damage by Salt Water

The foregoing, while showing a very prolific source of loss, does not really come under the definition of perils of the sea. When everything is safely stowed, hatches battened down, and the vessel squared away for her run, there are many opportunities for damage to cargo.

An instance occurs to me where a cargo was carried safely for 12,000 miles through fair weather and foul, only to have a very valuable portion of it almost irretrievably ruined while lying calm and peaceful in harbor. Modern cargo vessels are equipped with what are called deep tanks. These are situated in the main hold, just abaft the engine room bulkhead, and are carried

up to the twin decks and provided with watertight covers. When the ship is loaded they are used for cargo, but when the ship is in ballast they are filled with water, and serve the purpose of making the ship trim by the stern. This gives the propeller a better hold on the water and reduces the metacentric height, both desirable purposes. The deep tanks in this case had been utilized for a shipment of pianos and organs, and the vessel was at her final port of discharge in New Zealand, and was to proceed to Newcastle, N.S.W., in ballast after discharging. Everything was out of the holds except the lower tier of pianos in the deep tank, and these were expected to be finished late that night. The ship's carpenter had instructions to close up the tank when the cargo was finished and pass the word to the engine room to fill the tanks. Now there is always supposed to be one officer and one engineer aboard the ship, but this rule, like many others, is often broken. In this case the fourth engineer and third officer, who were the respective deck and engine-room officers on duty, decided that everything would be alright for a while aboard the ship, while ashore the girls were pretty and the wine was good. "Chips," which is the carpenter's official name, promised the third officer that all would be well, and the fourth engineer relegated his duties to the donkeyman. For some unexplained reason the longshoremen decided they would not finish the job that night, and left about 9 o'clock. "Chips," who had spent the intervening time communing with the spirits in his room, sensed the silence which ensued, and the spirit of duty, among others stirring within him, roused out his mate, and proceeded to close up the tank. This being done, the donkeyman was notified, and opened up the valves, letting the sea water rush merrily in. The third officer, coming aboard shortly after, was notified by the attendant "Chips" that all was shipshape and Bristol fashion; The fourth engineer was duly informed by the donkeyman that the tank was filling up. Everybody was happy with that contented feeling that comes with a duty well done. It was only in the morning when the crew were putting the finishing touches to battening down and making all secure, ready for sailing, that a cynical and sarcastic boss longshoreman arrived and delicately conveyed to the skipper the news that some thirty pianos were enjoying the benefits of a salt water treatment. As it is impossible to convey by cold type the impassioned utterances of the old man to the third mate, we will draw a veil over the harrowing scene. Suffice it to say that the third mate, like a good shipmate, kept quiet about the fourth engineer's absence. The engine room staff were clear, anyway, as they only carried out orders, but it would have been decidedly unpleasant for the fourth had it been known he was ashore also.

Another case was in carrying a cargo of soap, lye, and stuff of that nature down the Mediterranean. This cargo was in the after hold, and crossing the Bay of Biscay the vessel got a severe trouncing. The ship was pretty old and the straining caused the shaft tunnel to draw away from the tank top in places, besides which the after peak tank commenced to leak. The stern gland, which prevents, or should prevent the water leaking through the stern tube into the tunnel, was leaking badly, and the water found its way through the tunnel to the after hold. Some of the cases on the bottom of the hold got water soaked, and the contents disintegrated, so that the cases got smashed up, and the weight above them settled down, loosening up the whole stowage. The hold bilges naturally got choked up, and as these bilges act as a receptacle for all drainage being pumped out from the engine room, the water rose in the hold. The result was a greasy, slimy mess sweeping through into the tunnel, which made the tour of inspection necessary while on watch, a thing of peril to the unfortunate engineers. The leakage made it necessary to keep one of the bilge pumps continually pumping in the tunnel, and when the hold was finally opened up the whole of the cargo in the lower portion was a beastly mess, fit for nothing but pumping overboard.

Even such sturdy things as barbed wire and steel rails are not immune. It is usual to provide ventilators from the holds to the deck to use when the cargo makes it necessary. When not in use these ventilators are made so that the top part can be unshipped and the opening of the pipe, about two feet above the deck, is covered with tarpaulin to make them tight.

On the occasion I have in mind we were bound from Cardiff to Buenos Ayres with corrugated iron, barbed wire, and steel rails. The ship ran into very heavy weather while in the Bay of Biscay, that famous old bay. She had been hove to for about twenty-four hours, when, the weather moderating, it was decided to go ahead. The sea was still very heavy, and she made bad weather of it, finally shipping a sea that stove in the starboard bulwarks and swept the ventilators clean with the decks. The result was that tons of water found their way into the holds, and a considerable amount of barbed wire was so badly rusted on arrival that the consignees refused to accept it.

There is of course always the danger of fire and collision, resulting in total loss, and damage through hatches being stove in as a result of bad weather. Cargo is still damaged through inefficient stowage, though this is rare. These few instances will serve to show that the merchant with goods on the high seas is still liable to the anxieties which beset Bassanio and gave Portia the opportunity to show that a lawyer may still be a lover.

In the course of a paper on the "Air-lift System of Raising Oil," read before the Institution of Petroleum Technologists, Mr. R. Stirling mentioned that the arguments against the use of the air lift are that the inflow of the water is induced thereby, and that with very heavy viscious oils, if over 5 per cent. and under 20 per cent. of water be present with the oil an emulsion may be formed from which it is difficult to separate the water. In a well with 10 to 15 per cent. of water, the difficulty was overcome by running into the well an additional 20 per cent. of water. No serious emulsion was then formed, and the discharge was much facilitated and increased.

The manufacturers of concrete pipes by the "Hume" centrifugal process—Hume Pipe Company, South Africa, Limited—is described in a paper by Mr. W. Wolstenholme recently read before the South African Institution of Engineers. The materials employed with the cement are crushed stone from the mines in the Witwatersand area, and, for reinforcement, discarded winding ropes, of which large quantities are available. The ropes which are slowly rotated, are cut into suitable lengths, annealed, and unstranded, and then woven into cages which are placed in the pipe moulds first. The concrete is thrown into the moulds until the required amount is furnished, the machine is gradually speeded up, and the centrifugal force causes the material to be evenly distributed throughout the length of the moulds; water is also driven out by this method. Six 4-in. or 6-in. diameter pipes can be completed in eight or nine minutes, and four 15-in. or 18-in. pipes in fifteen minutes. Larger sizes up to 60 in. diameter can be finished in about twenty minutes. Sizes up to 9 in. diameter will withstand a working pressure of from 300 to 350 lb. per square inch, while larger sizes have been tested up to 210 lb. per square inch. When subjected to excessive pressure these pipes become a mass of pores, and have cracks which allow the pressure to escape. The pipes do not, therefore, fail in the manner of a cast iron pipe.

Following the developments that will eventually give Montreal additional electrical equipment for the pumping of water at the low level pumping station, the League of Proprietors, at a recent meeting, passed a resolution condemning the proposed contract that had been contemplated for the supplying of electrical energy. The objection is based on the belief that the term of twenty-five years is too long, as changing conditions may make it possible for the city to obtain power at a cheaper rate. The commissioners have decided to call for tenders in connection with these power requirements

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NOTICE TO MARINERS
No. 31 of 1920
(Inland No. 11)

All bearings, unless otherwise noted, are true and are given from seaward in degrees from 0° (North) to 360°, measured clockwise, followed by the magnetic bearing in degrees in brackets, miles are nautical miles, heights are above high water and all depths are at mean low water.

ONTARIO

(72) Lake St. Clair—Mouth of Thames River—Gas buoy replaced

Former notice.—No. 18 (45) of 1920.
Date.—Without further notice.
Position.—At outer end of dredged cut, 1½ miles 320° 30′ from Thames river main light.
Latitude N. 42° 20′ 16″ Longtitude W. 82° 28′ 30.″
Buoy replaced.—The gas buoy that was adrift will be replaced on its former position.
N. to M. No. 31 (72) 25-5-20.
Authority.—Departmental records.
Admiralty charts.—Nos. 330 and 332.
Publication.—U. S. Lake Survey Bulletin No. 28, page 364.
Canadian List of Lights and Fog Signals, 1920.—No. 1902.
Departmental File.—No. 30571.

ONTARIO

(73) Georgian bay—Nottawasaga river mouth—Change in position of range lights

Former Notice.—No. 45 (116) of 1918.
New position of front light.—On east side of mouth of river, 247 feet northeast of the old site.
Latitude N. 44° 32′ 5″ Longitude W. 880° 00′ 55.″
New position of back light.—264 feet 111° 10′ (S. 61° 50′ E. mag.) from front light.
Depth of water.—The alignment leads over the bar outside the mouth of the river with a least depth of 5 feet.
N. to M. No. 31 (73) 25-5-20.
Variation in 1920.—7° W.
Authority.—Report from Agent, Department of Marine, Parry Sound.
Canadian Naval chart.—No. 100.
Publication.—Sailing Directions for Georgian Bay, 1915, page 147.
Canadian List of Lights and Fog Signals, 1920.—Nos. 1998 and 1999.
Departmental File.—No. 21998R.

A. JOHNSTON
Deputy Minister.

Department of Marine and Fisheries,
Ottawa, Canada, 25th May, 1920.

No. 36 of 1920
(Inland No. 13).

ONTARIO

(85) Bay of Quinte—Nigger island—Change in character of light

Date.—Without further notice.
Position.—On pier, on north side of channel.
Latitude N. 44° 6′ 32″. Longitude W. 77° 29′ 50″.
Change in character of light.—The fixed white light will be replaced by an occulating white acetylene light, automatically occulated at short intervals.
Remarks.—The light is unwatched.
N. to M. No. 36 (85) 11-6-20.
Authority.—Departmental Records.
Canadian Naval Chart.—No. 69.
Publication.—U. S. Lake Survey Bulletin, No. 28, page 501.
Canadian List of Lights and Fog Signals, 1920.—No. 1768.
Departmental File.—No. 21768K.

UNITED STATES OF AMERICA

(86) St. Marys river—West Neebish Channel—Beacon destroyed— Temporary gas buoy established

East side upper light No. 6 has been destroyed and until the light is reconstructed a temporary gas buoy showing a flashing red light has been established in 22 feet of water on the channel bank immediately above the location of the light.
N. to M. No. 36 (86) 11-6-20.
Authority.—U . S. Department of Commerce N. to M. No. 22 of 1920.
Publication.—U. S. Lake Survey Bulletin No. 28, page 135.

A. JOHNSTON,
Deputy Minister.

Department of Marine and Fisheries,
Ottawa, Canada, 11th June, 1920.

No. 41 of 1920
(Inland No. 14).

ONTARIO

(97) Ottawa river—West entrance to Carillon canal—Buoy established

Position.—On north edge of shoal, about 3750 feet west of Carillon dam.
Description.—Black wooden spar buoy.
Authority.—Report from Agent, Department of Marine, Montreal.
Department File.—No. 25049.
N. to M. No. 41 (97) 24-6-20.

ONTARIO

(98) Lake Superior—Otter Island—Light re-established

Date.—Without further notice.
Position.—On northwest extremity of the island.
Latitude N. 48° 6′ 43″, Longitude W 86° 4′ 00″.
Character.—Flashing white catoptric light, showing one flash every 8 seconds.
For half the time between flashes or 4 seconds teh light will be totally eclipsed for the remainder of the time a fixed light of 450 candle-power will be visible through which the stronger flash will show.
Power.—Naked light 450 candles, flash 20,000 candles.
Illuminant.—Petroleum vapour burned under an incandescent mantle.
N. to M. No. 41 (98) 24-6-20
Authority.—Departmental records.
Canadian Naval charts.—No. 108.
Publication.—U. S. Lake Survey Bulletin No. 28, page, 117.
Canadian list of Lights and Fog Signals, 1920.—No. 2177.
Departmental File.—No. 22177A.

UNITED STATES OF AMERICA

(99) St. Marys river—Middle Neebish channel—Floating Plant at work—Caution.

Vessel masters are advised that during the next two or three months a floating plant will be employed by the Lighthouse Service in the rebuilding of structures in the Middle Neebish channel. It is requested that vessels exercise care to slow down in passing work under construction

Continued on page 48

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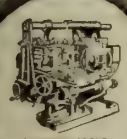
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MARINE NEWS FROM EVERY SOURCE

Ottawa—There have been up to date thirty-two of the Canadian Government's ships completed and it is confidently expected that by March next the whole programme, consisting of 63 vessels, will have been delivered.

Kingston:—Owing to delay in dredging considerable trouble is being encountered by vessels in Kingston harbor. One result is that vessels loading at Oswego and compelled to go with only part cargo to avoid trouble.

Washington—The Shipping Board has been unsuccessful in finding tenderers for the wooden ships it recently placed on the market. Not one tender was received. The vessels were part of the U.S. wooden shipbuilding programme, and total about 83,000 tons deadweight.

Kingston,—The big dredge, "Kennequhair," which was bought from the Great Lakes Dredging Co. by the Dominion Government back in 1917, has been made ready for a voyage. Originally bought for work on the Hudson Bay Terminals, she has been lying in Cornwall dry dock for nearly three years. She will now be employed at Cape Tormontine, P.E.I., on the terminal there.

Vancouver—The S.S. "Indus" was launched from the yard of the Coughlan Co. early in July. The vessel which was laid down for the builders, was purchased by the East Asiatic Company, of Sweden, while on the stocks. She will be completed early in August, having been launched with her engines installed This vessel brings the total tonnage up to 146,800 and the number of vessels launched up to 17.

Buenos Ayres—The Italian steamer "Belluno" arrived in the port of Buenos Ayres recently flying the red flag of Communion at the peak, and the Italian national flag at the stern. All hands from captain to cabin boy operate on a basis of equality, with the exception that certain powers have been delegated to the officers to enable them to carry on the work of the ship, with the necessary discipline. Everybody gets the same pay, but officers are allowed a certain extra sum for expenses. The cargo was owned by the Genoa Co-Operative Society, of which the captain is a director, and the crew members. The vessel entered the harbor with the crew lined up along the rail waving red flags. Her entrance was the signal for a great demonstration on the part of the Buenos Ayres Maritime Federation.

Toronto:—The Dominion Shipbuilding Co., successfully launched the steamer "Floraba" from their yard at the foot of Spadina Ave. This is the second vessel for the Gulf Navigation Co., of New Orleans, the first having been launched about three weeks ago, and now ready for delivery. The vessel is of the usual dimensions for passing the Lower St. Lawrence Canals. A large and influential gathering witnessed the launching ceremony.

St. Catharines—There were some exciting moments when the steamer "Maple Grove," formerly the "Cherokee" crashed through the lock gates and went from the high level to the low in one jump. The same vessel did the same trick six years ago. The "Maple Grove" was carrying a full cargo of wheat, and after entering the head gates, the captain signalled for the engines to be reversed to check her weigh, instead of which the engineer is said to have gone full speed ahead, with the result that the steamer carried away the gates at the lower end of the lock, and plunged through. She was carried down at a high rate of speed towards the foot bridge and gates of Lock 1, and in order to save going through that, the captain ran her into the bank where she stuck hard and fast. The vessel and cargo were not damaged, but the canal was damaged to the extent of about $7,500. The engineer collapsed and had to be taken to the General and Marine Hospital.

Ottawa—Some information was given in the House of Commons relative to the amount of money spent on harbors since Confederation, by the Hon. A. L. Sifton. The Department of Marines and Fisheries had expended through the Harbor Commissions $28,785,308 at Montreal and $10,809,807 at Quebec. The Department of Public Works spent the following sums: Halifax, $75,569.64. The outlay connected with terminal facilities were paid for by the Department of Railways and Canals. St. John, $14,636,146; Quebec, $12,060,263; Montreal, $5,978,324; Toronto, $6,014,259; Port Arthur, $4,078,457; Hamilton, $587,336; Fort William, $8,790,408; Victoria, $6,928,919; Vancouver, $4,410,450. The Intercolonial Railway expended the following sums at Halifax and St. John: Dredging at St. John, $28,584. Wharves at St. John, $457,807. Wharves at Halifax, $1,453,948. Dredging and blasting at Halifax, $128,986. Removing boulders, etc., ran into much money, and the total expenditure on both harbors by the I.C.R. was $8,879,927.

Port Arthur—The Port Arthur Shipbuilding Company, Limited, launched the C.G.S. "Canadian Carrier" on Saturday, June 26th, 1920, at 12.00 a.m. This vessel is being built for the Department of Marine of Canada, and, by the request of the Minister of Marine, Mrs. J. W. Wolvin, of Port Arthur, Ontario, acted as sponsor for the vessel. The "Canadian Carrier" is a sister ship of the "Canadian Runner," launched by the Port Arthur Shipbuilding Company, Limited, on May 8th, and now about fully completed and ready to sail. She will take a full cargo of grain from Port Arthur to Buffalo. Both these vessels are over-canal size, and will be cut at Buffalo, and taken through the Welland and St. Lawrence Canals in sections, and rejoined at Montreal or Quebec. The contract of the Shipbuilding Company calls for them to be delivered at either of these ports. Following are the leading dimensions and particulars of these vessels:

Length, 335 feet over all.
Beam, 44 feet.
Depth,25 feet.

of 4,400 deadweight tons, fitted with 'tween decks, with poop, bridge and forecastle.

Two Scotch boilers, 15 x 11 ft., Howden forced draught, designed for a working pressure of 180 pounds.

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Tadousac—The "Canadian Recruit" of the Canadian Government Merchant Marine has been refloated after being ashore at Mille Vacha since last December. She was built at the yard of the Collingwood Shipbuilding Company at Collingwood, and left Quebec last December for a voyage to the West Indies. The season being far advanced, she speedily got into trouble in the ice, and lost her rudder, finally drifting ashore, where she remained till just recently. She will be drydocked in Quebec, where an estimate of the damage and cost of repairs will be made.

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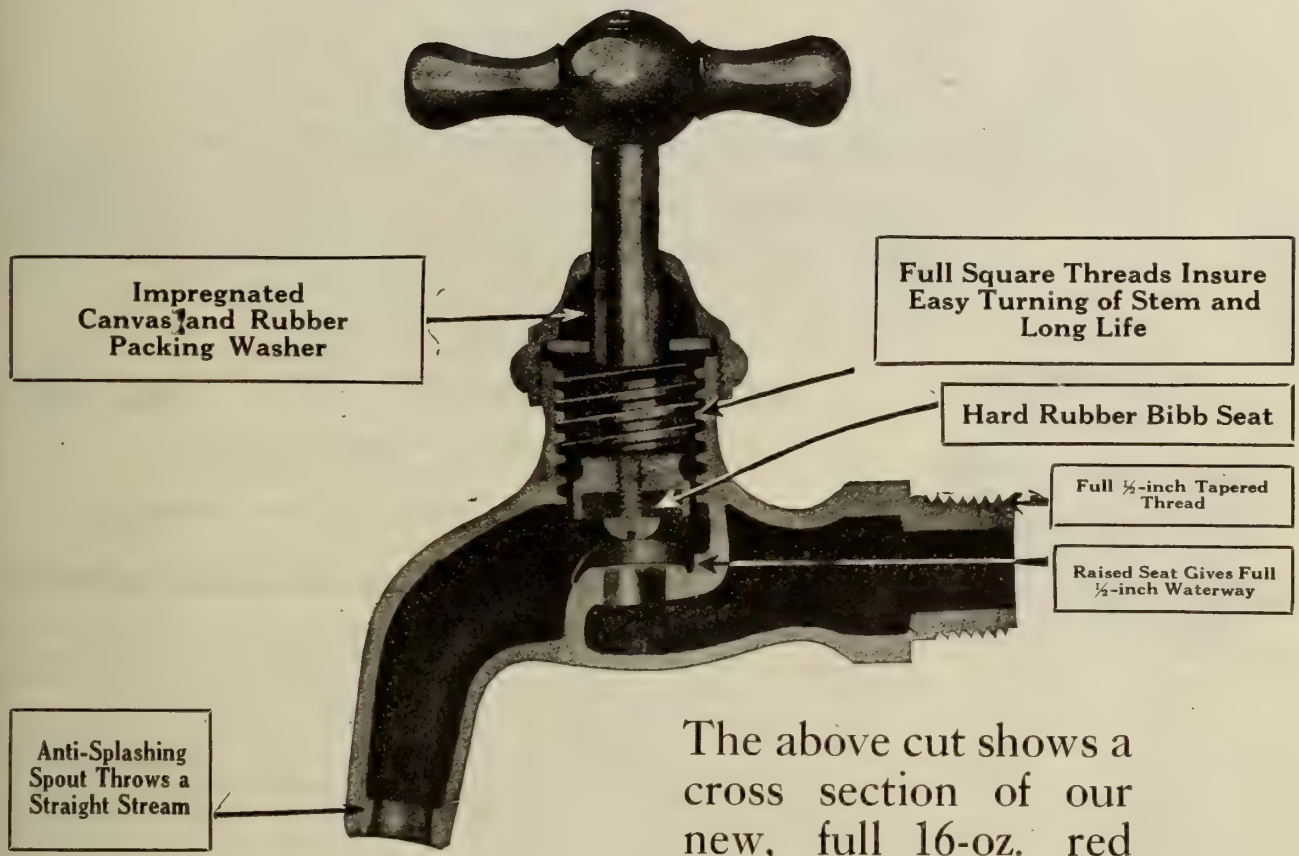
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NOTICE TO MARINERS

Continued from page 190

as much as possible to avoid damage to the floating plant and other work,

N. to M. No. 41 (99) 24-6-20.

Authority.—U. S. Department of Commerce N. to M. No. 24 of 1920.

Publication.—U. S. Lake Survey Bulletin No. 28, page 136.

UNITED STATES OF AMERICA

(100) Lake Superior—Whitefish point light station—Change in characteristic of submarine bell

Position.—In 30 fathoms, 2,185 yards north of Whitefish point lighthouse.

After 25th May, 1920, the bell will strike 4 strokes every 16 seconds.

N. to M. No. 41 (100) 24-6-20.

Authority.—U. S. Department of Commerce N. to M. 23 of 1920.

Publication.—U. S. Lake Survey Bulletin No. 28, page 53.

A. JOHNSTON,
Deputy Minister.

Department of Marine and Fisheries,
Ottawa, Canada, 24th June, 1920.

No. 44 of 1920
(Inland No. 15.)

QUEBEC

(107) St. Lawrence river from Quebec to the east end of Lake Ontario—New edition of St. Lawrence Pilot, (above Quebec).

A new edition of the St. Lawrence River Pilot, (above Quebec) comprising sailing directons from Quebec to the east end of Lake Ontario has just been published by the Hydrographic Survey Department of the Naval Service of Canada.

Copies may be obtained from the Hydrographic Survey, Department of the Naval Service, Ottawa, for twenty-five cents per copy, payable in advance.

N. to M. No. 44 (107) 29-6-20.

Department File.—No. 25786.

ONTARIO

(108) Canadian shores of Lake Huron and Georgian Bay—New edition of Sailing Directions

A new edition of "Sailing Directions for the Canadian Shores of Lake Huron and Georgian Bay" has just been published by the Hydrographis Survey, Department of the Naval Service.

Copies may be obtained from the Hydrographic Survey, Department of the Naval Service, Ottawa, for twenty-five cents per copy, payable in advance.

N. to M. No. 44 (108) 29-6-20.

Departmental File.—No. 19390.

ONTARIO

(109) Lake Superior—Michipicoten island, south side—Davieaux island —Auxiliary fog horn

Position.—On summit of island.

Latitude N. 47° 11′ 42″, Longitude W. 85° 48′ 40″.

Auxiliary fog horn.—A hand fog hor has been placed at the lighthouse and wil be sounded should the fog bell becom disabled.

N. to M. No. 44 (109) 29-6-20.

Authority.—Report from Agent, De partment of Marine, Parry Sound.

Canadian Naval chart.—No. 108.

Publication.—U. S. Lake Survey Bul letin No. 28, page 117.

Canadian List of Lights and Fog Sig nals, 1920.—No. 2173.

Department File.—No. 22173F.

A. JOHNSTON,
Deputy Minister

Department of Marine and Fisheries,
Ottawa, Canada, 29th June, 1920.

Pilots, masters or others interested ar earnestly requested to send informatio of dangers, changes in aids to naviga tion, notice of new shoals or channels errors in publications, or any other fact affecting the navigation of Canadian wa ters to the Chief Engineer, Department o Marine and Fisheries, Ottawa, Canada Such communications can be mailed fre of Canadian postage.

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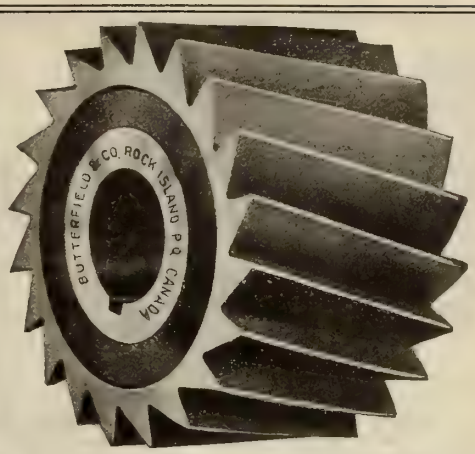

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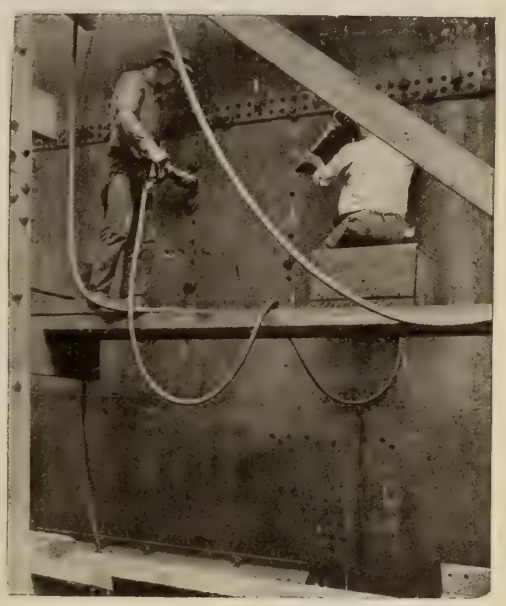

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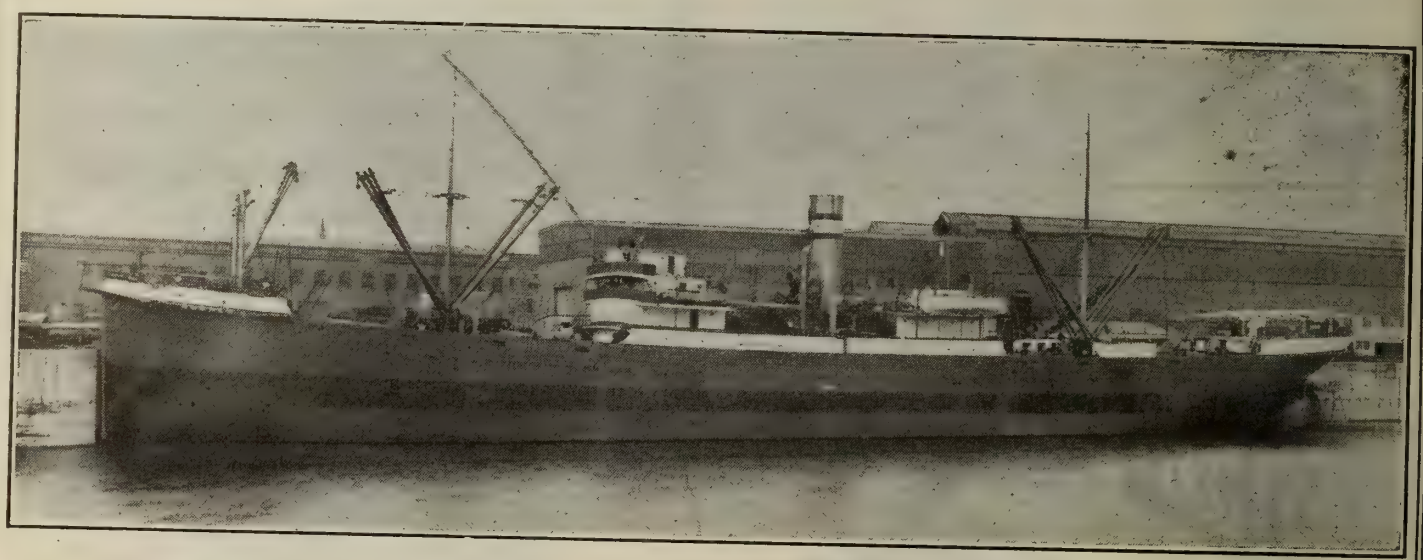

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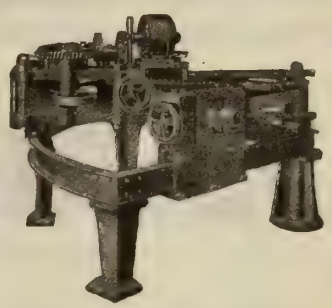

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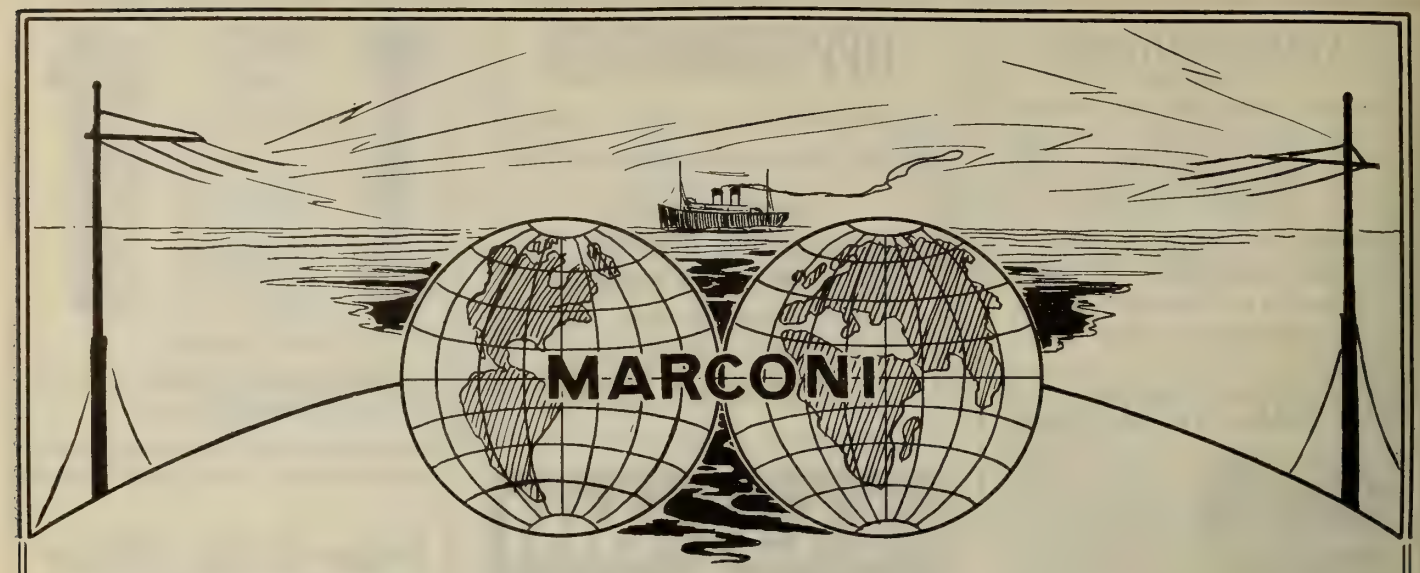

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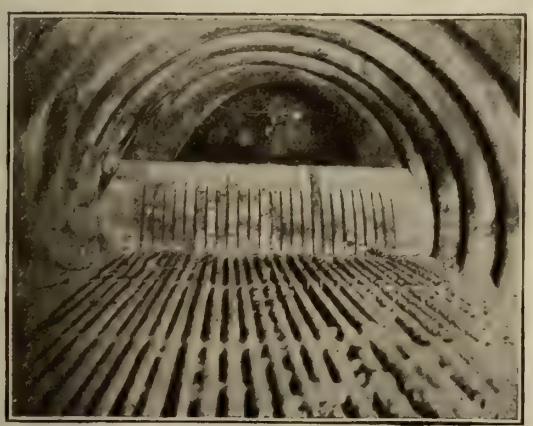

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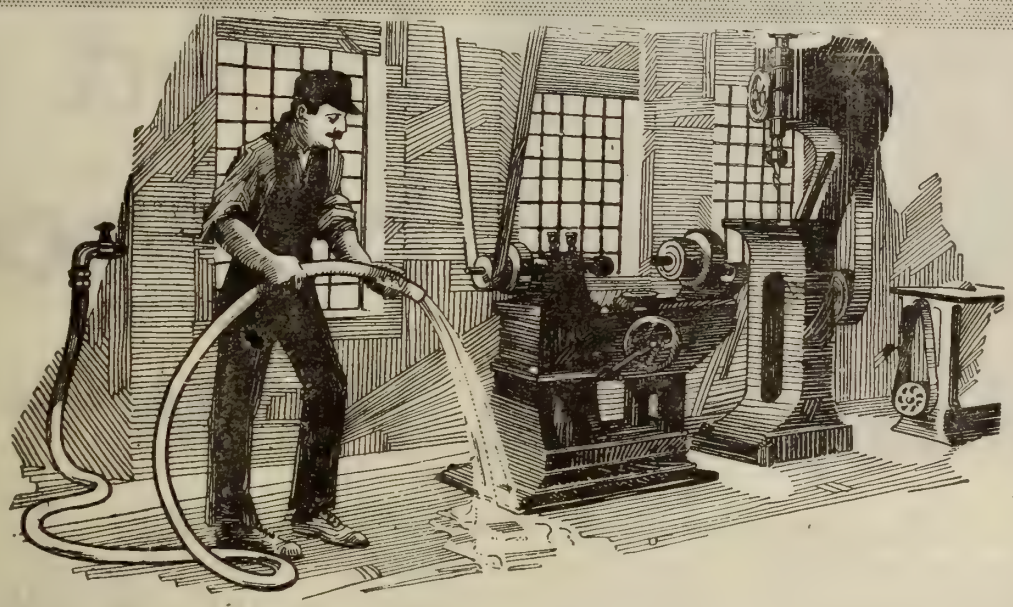

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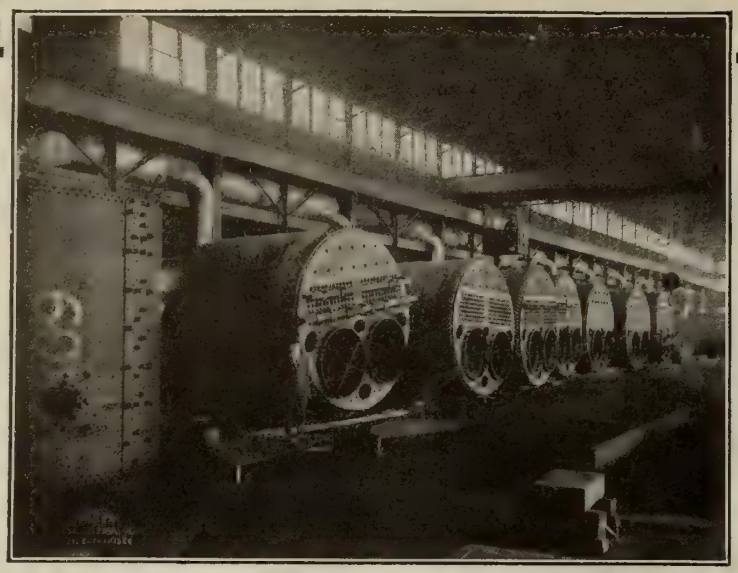

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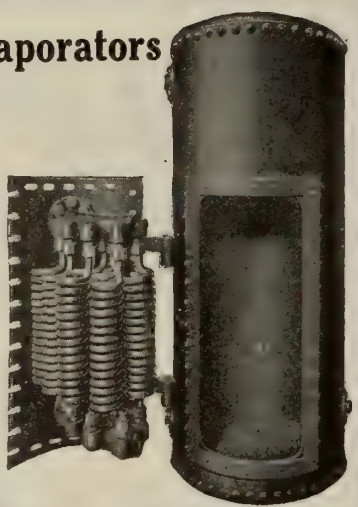

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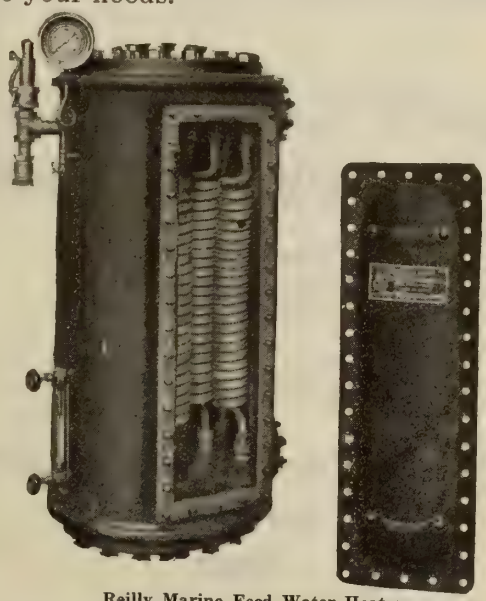

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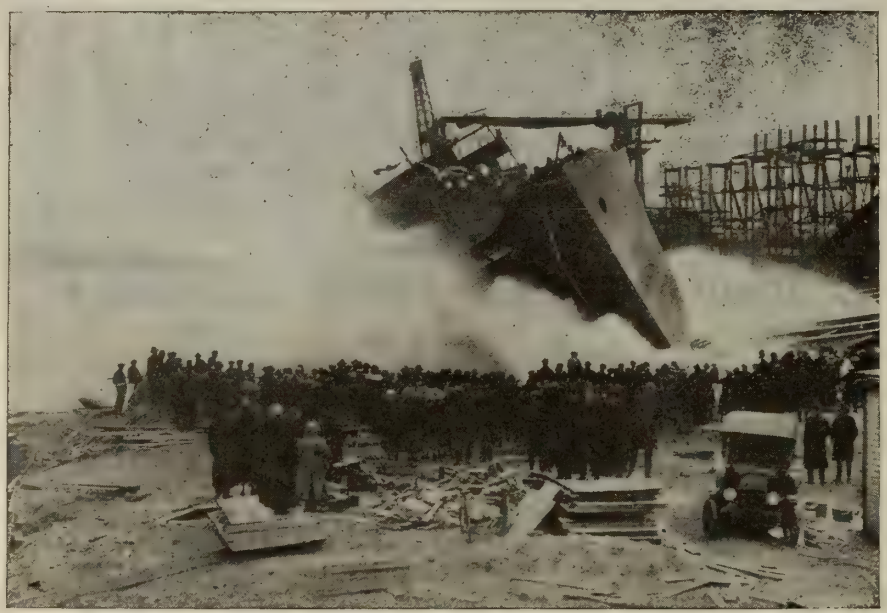

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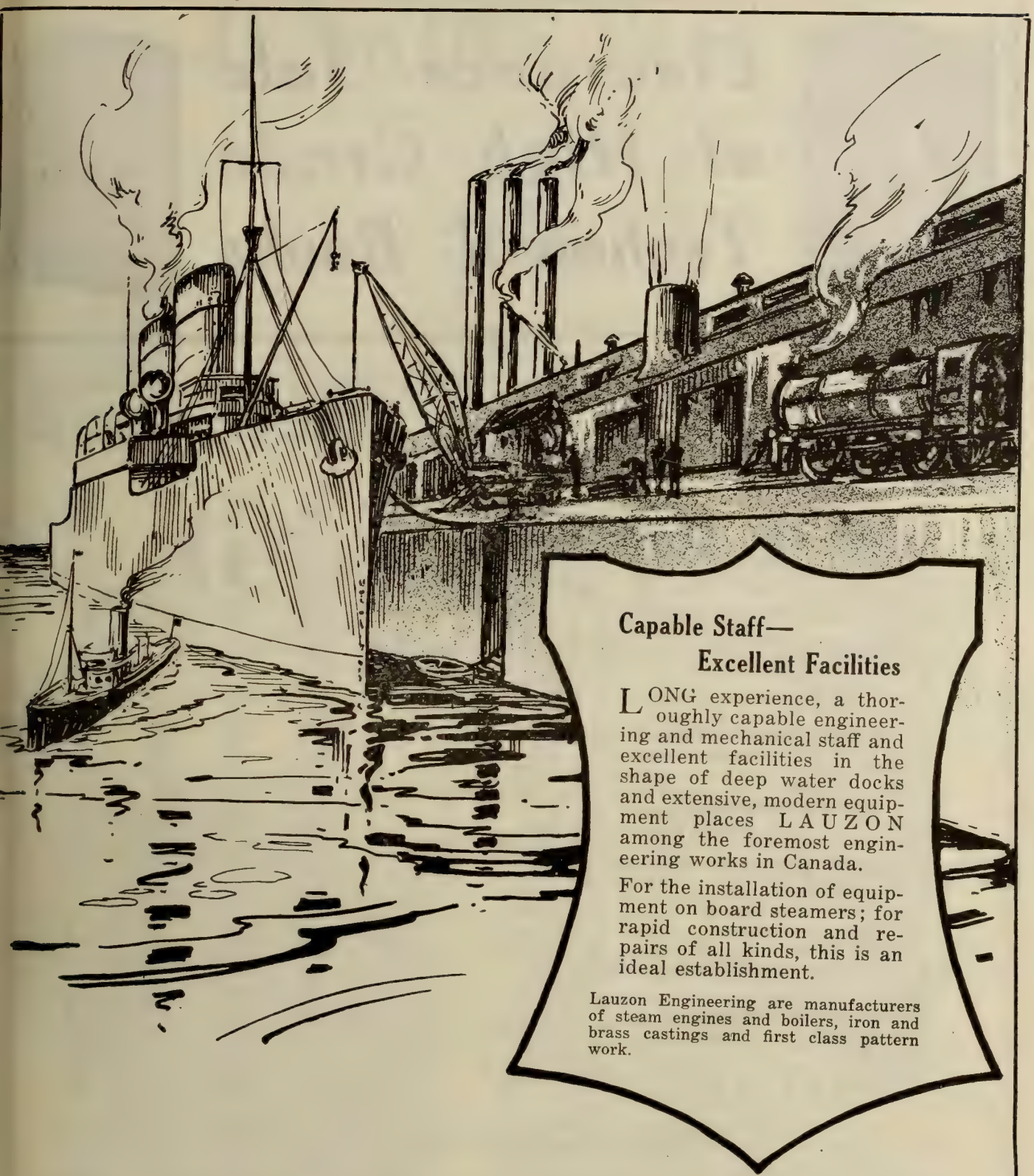

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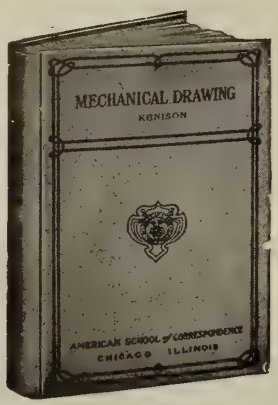

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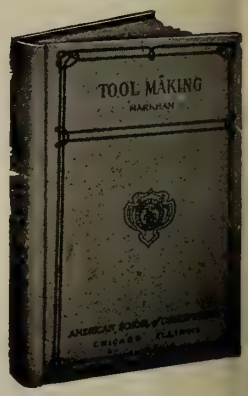

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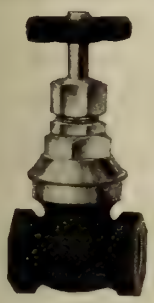

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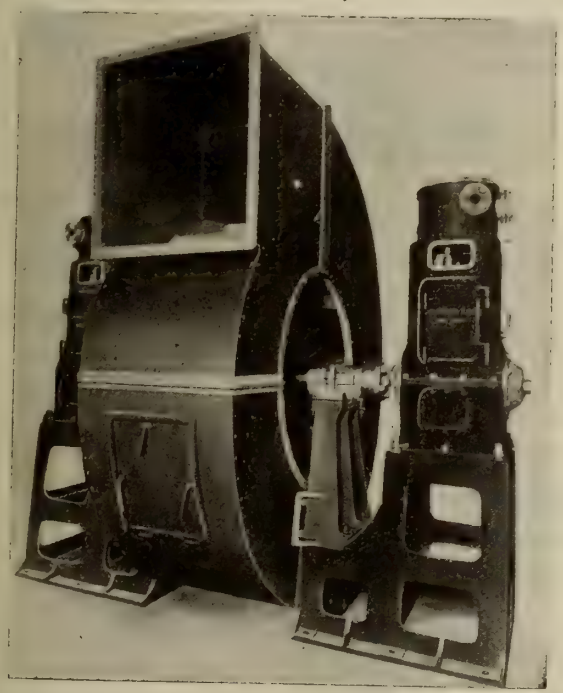

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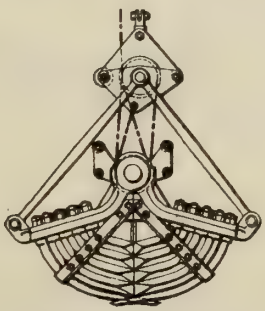

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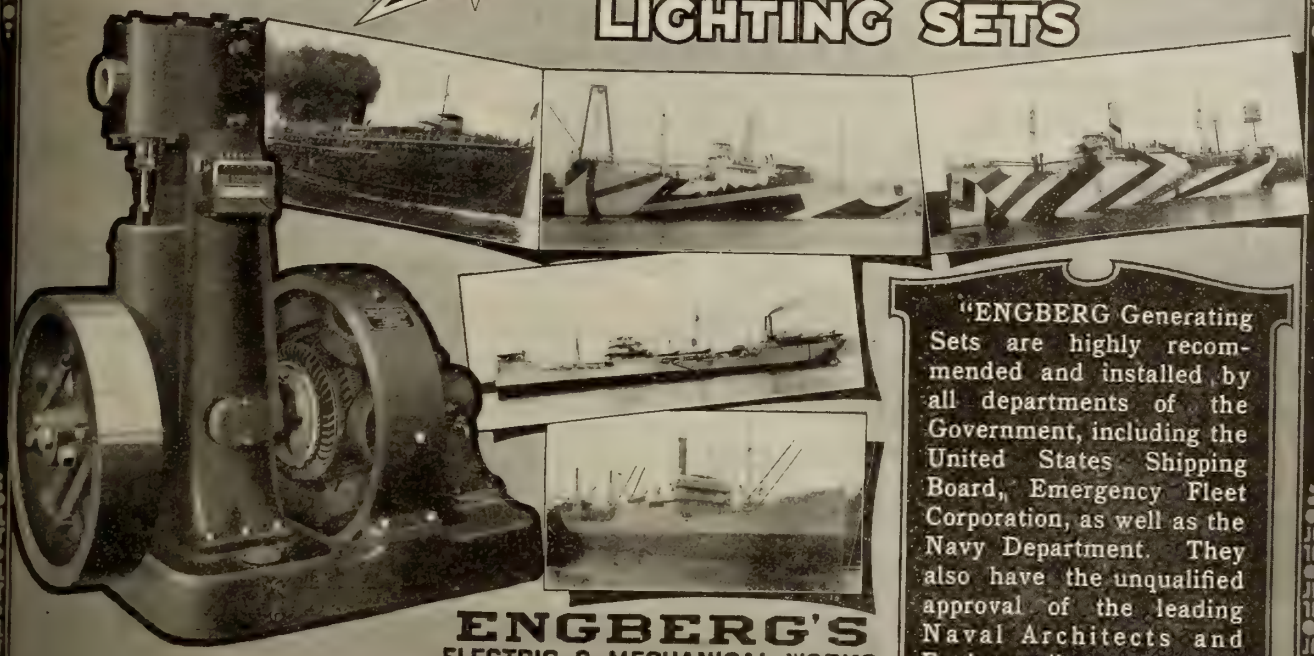

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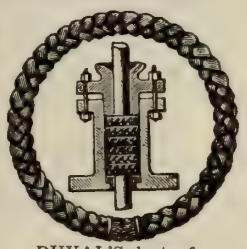

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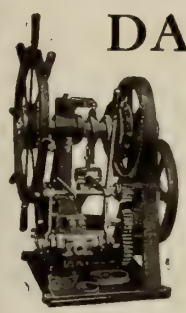

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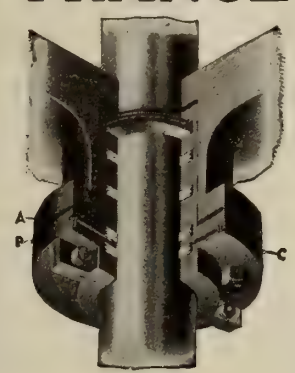

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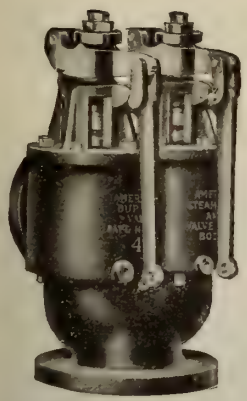

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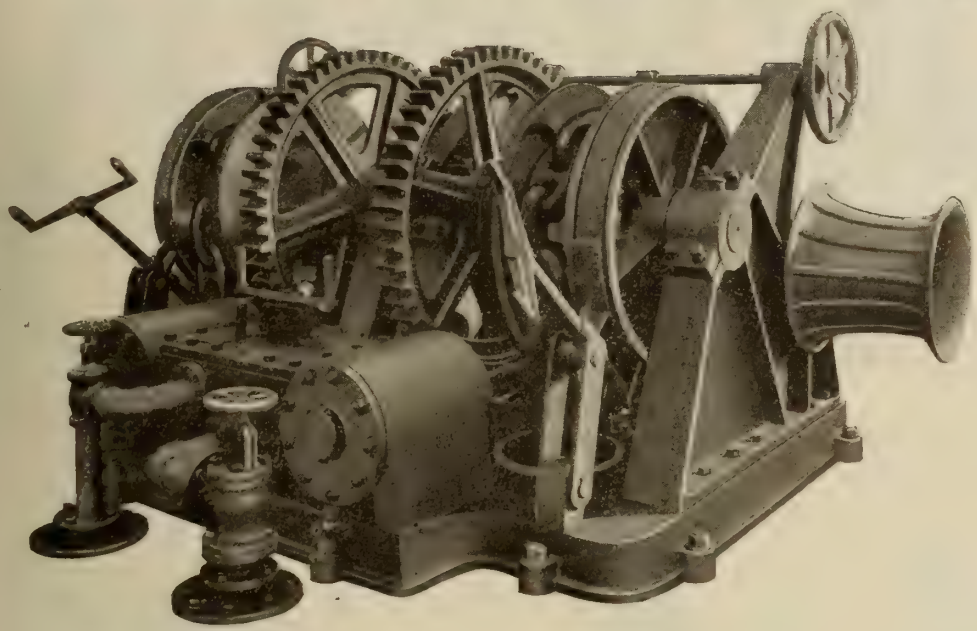

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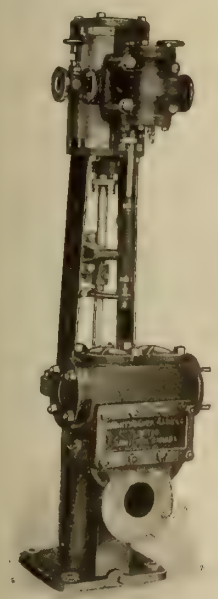

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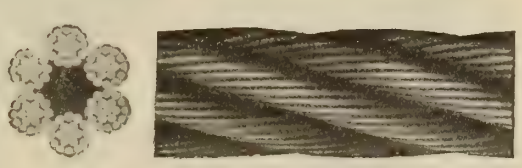

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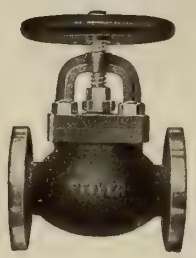

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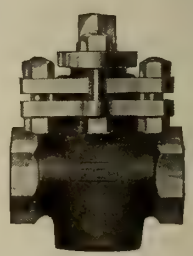

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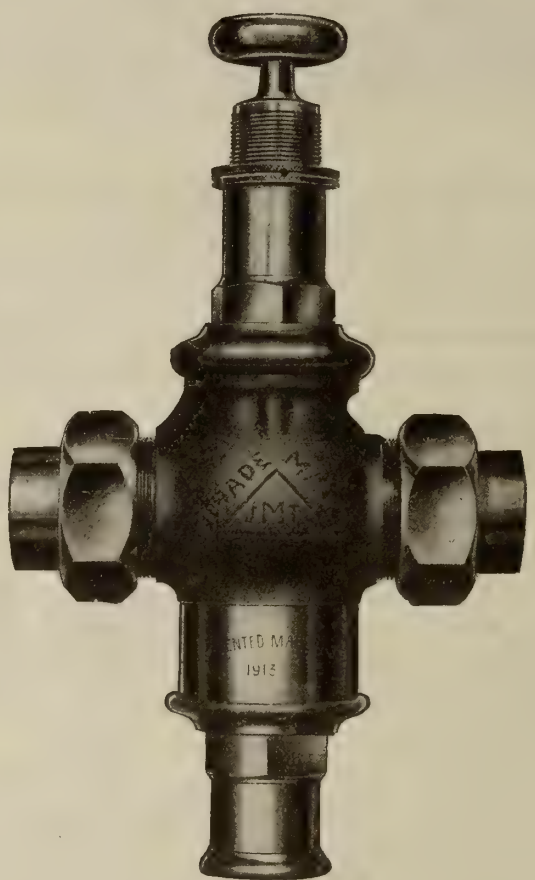

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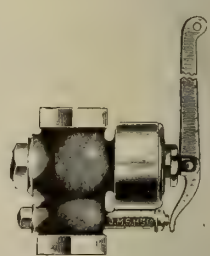

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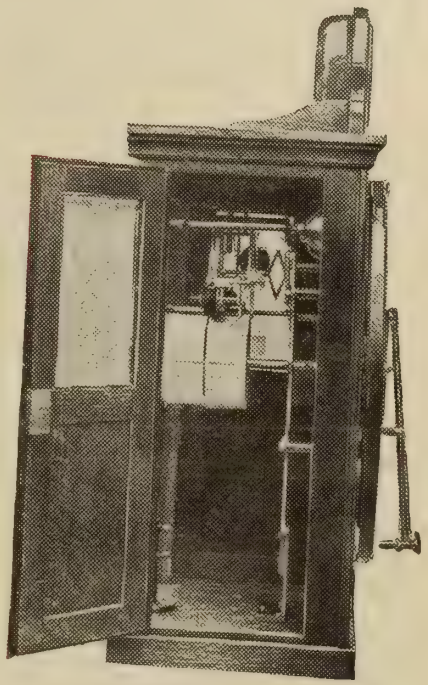

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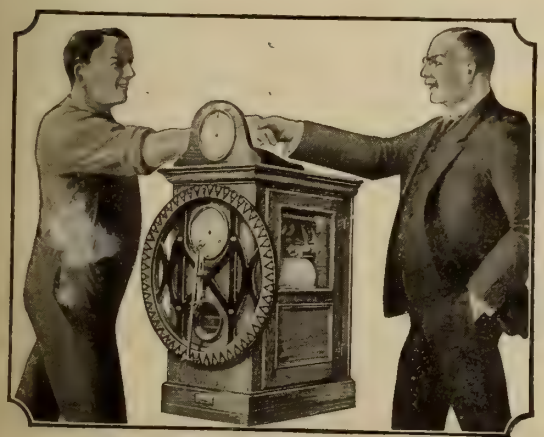

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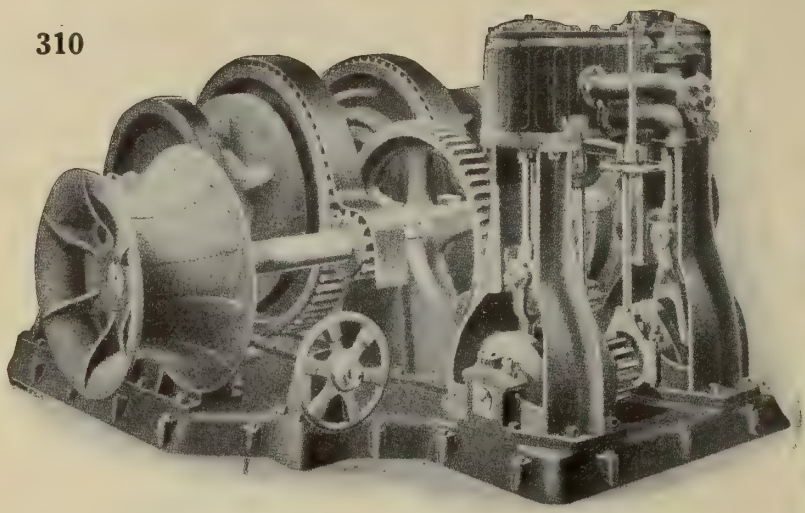

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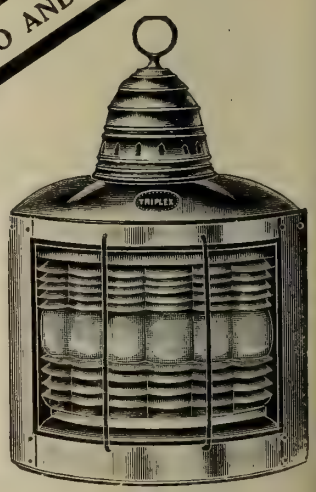

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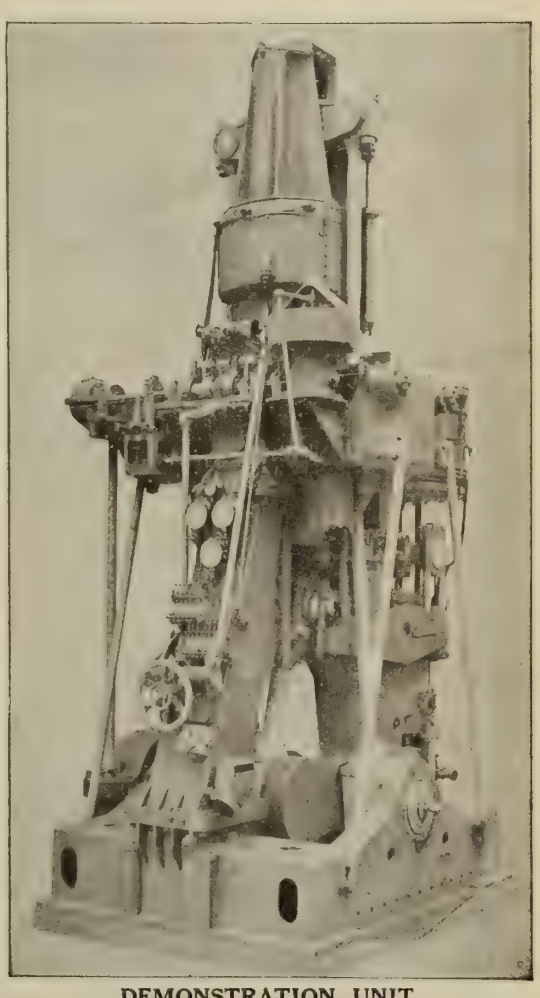

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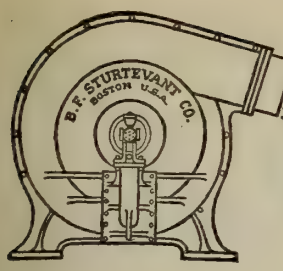

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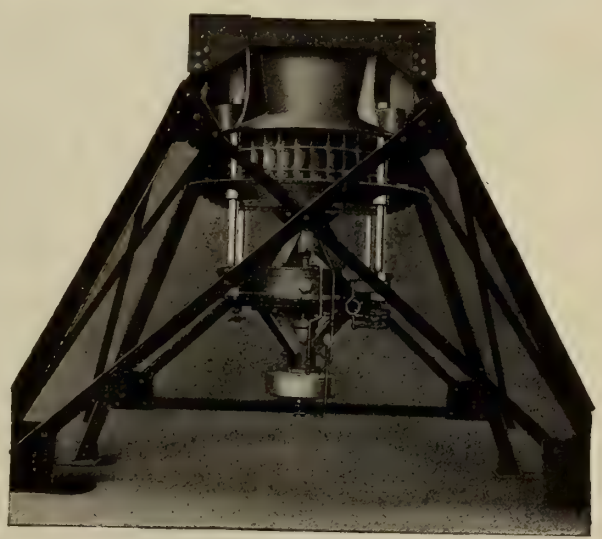

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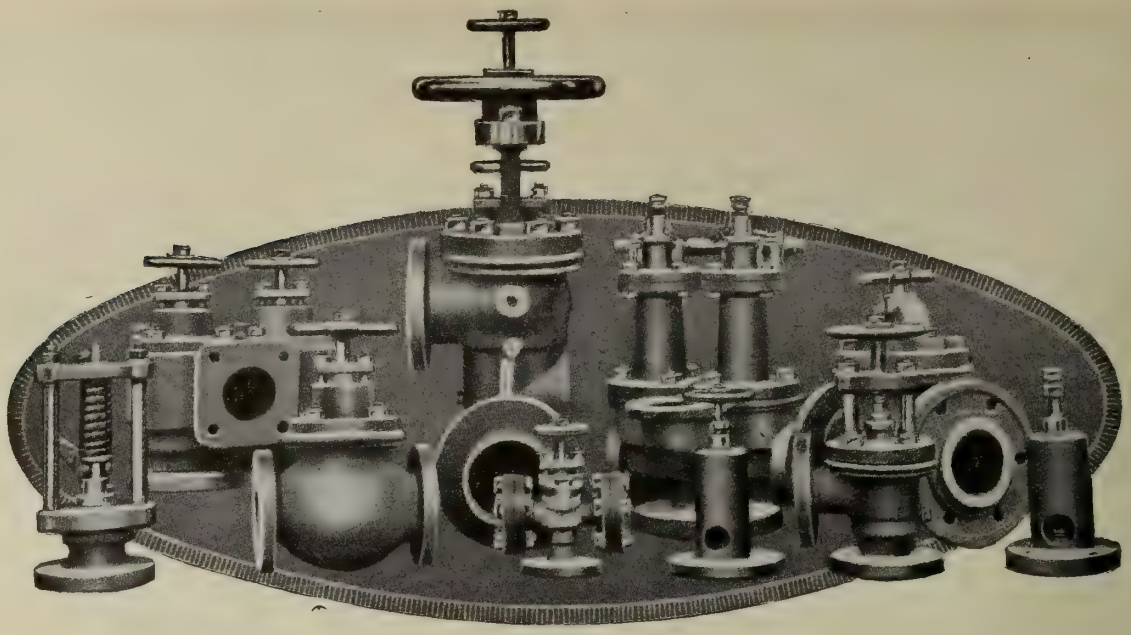

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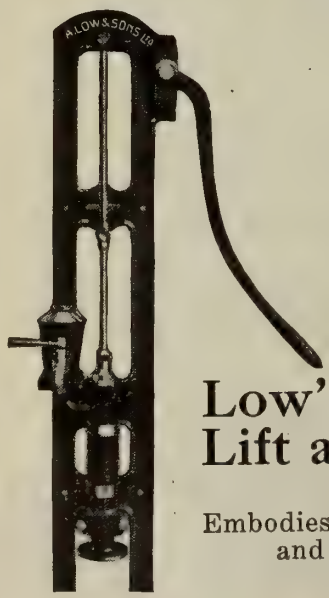

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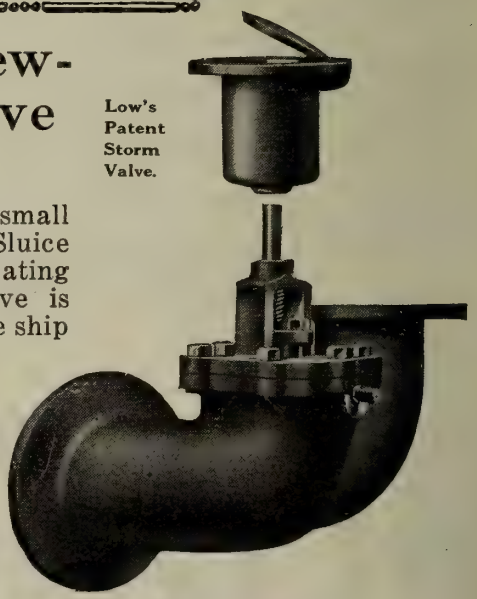

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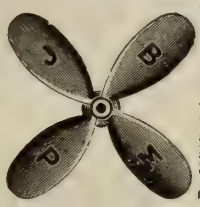

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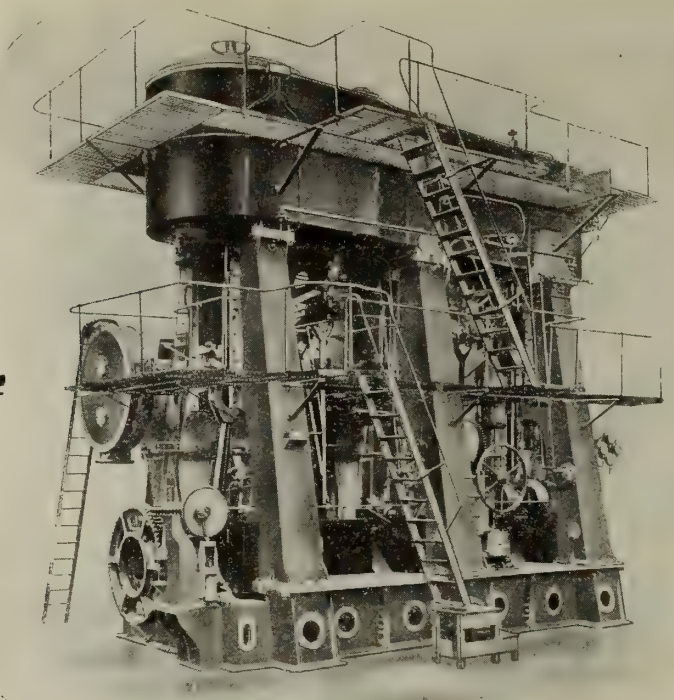

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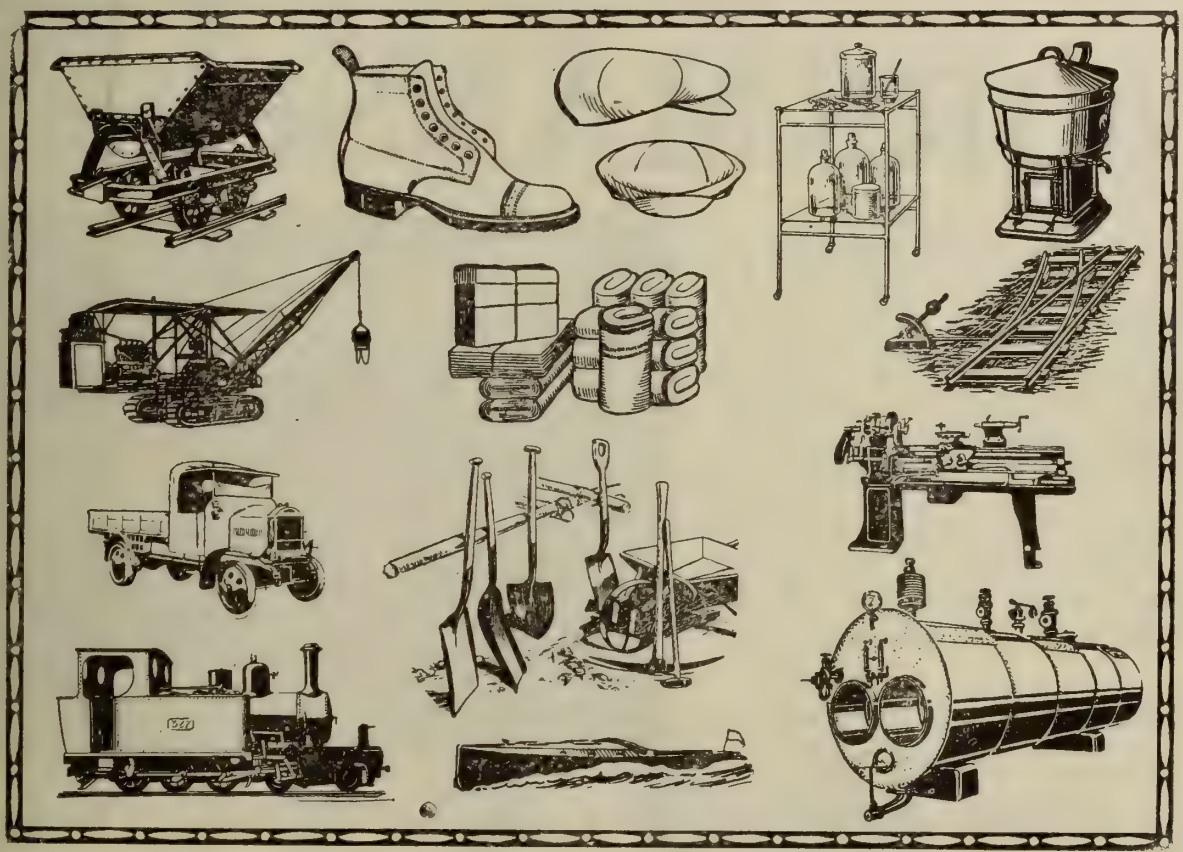

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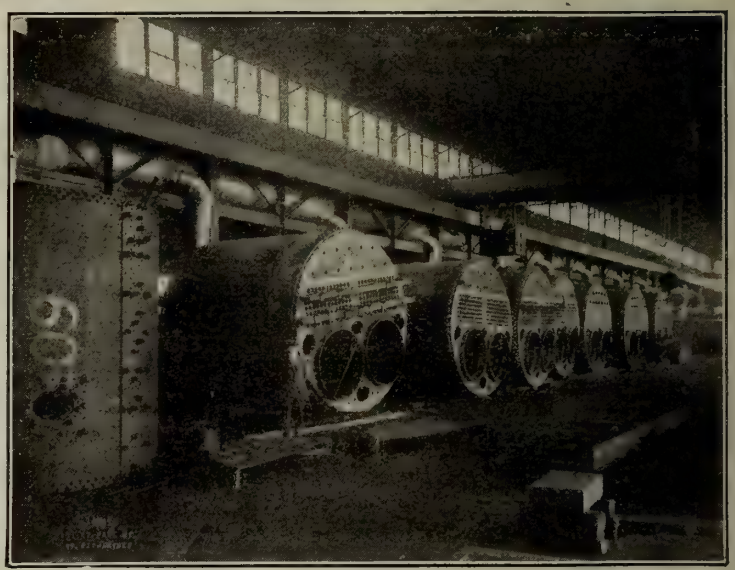

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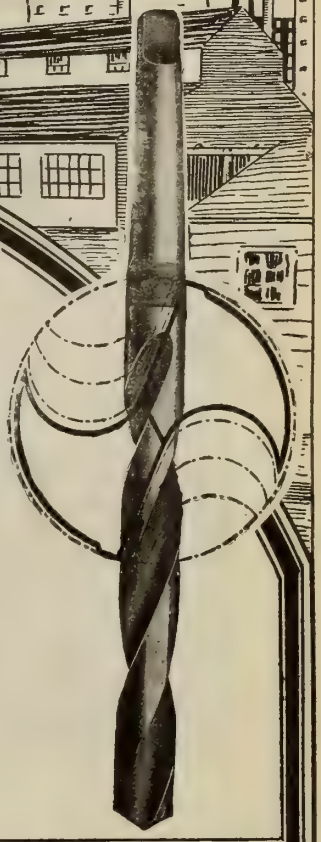

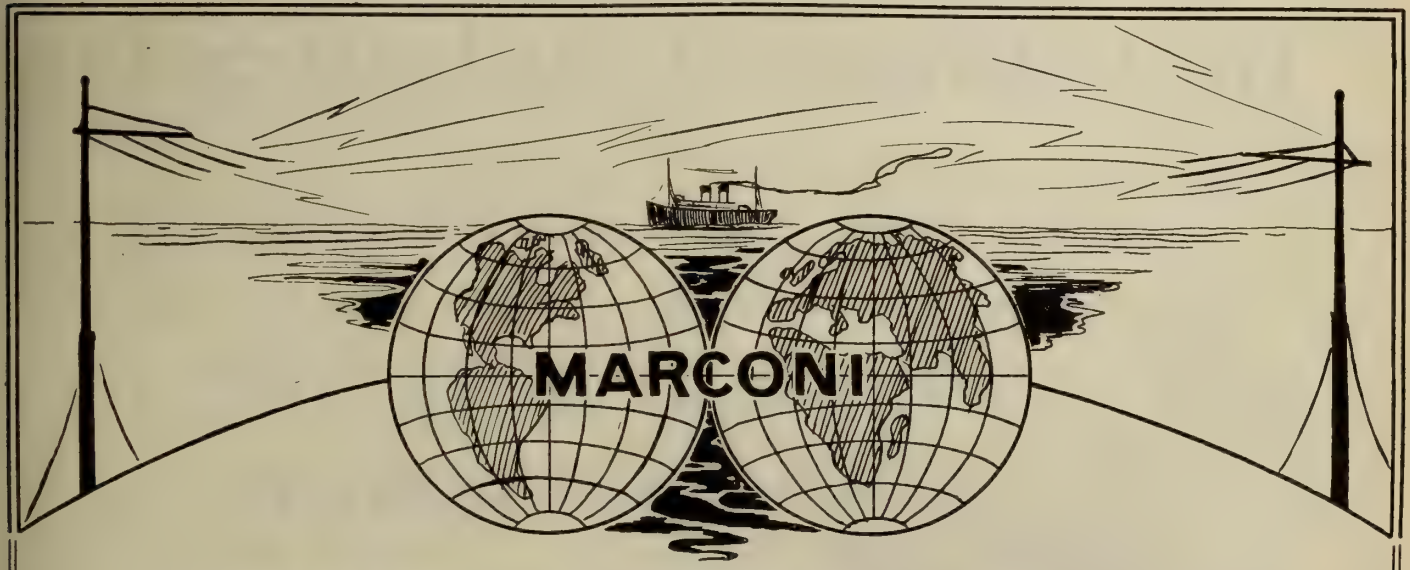

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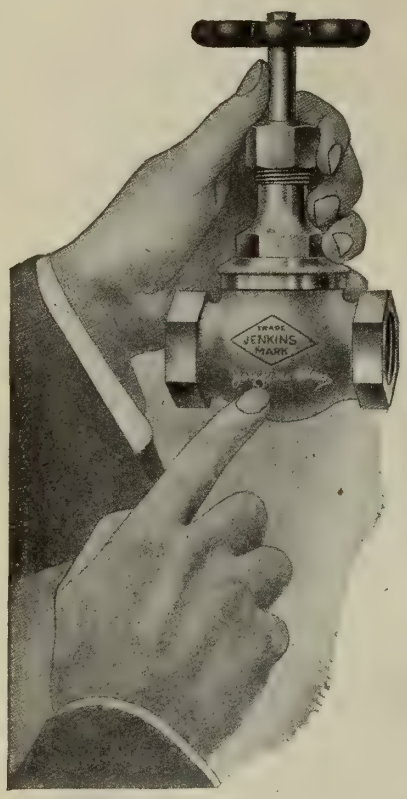

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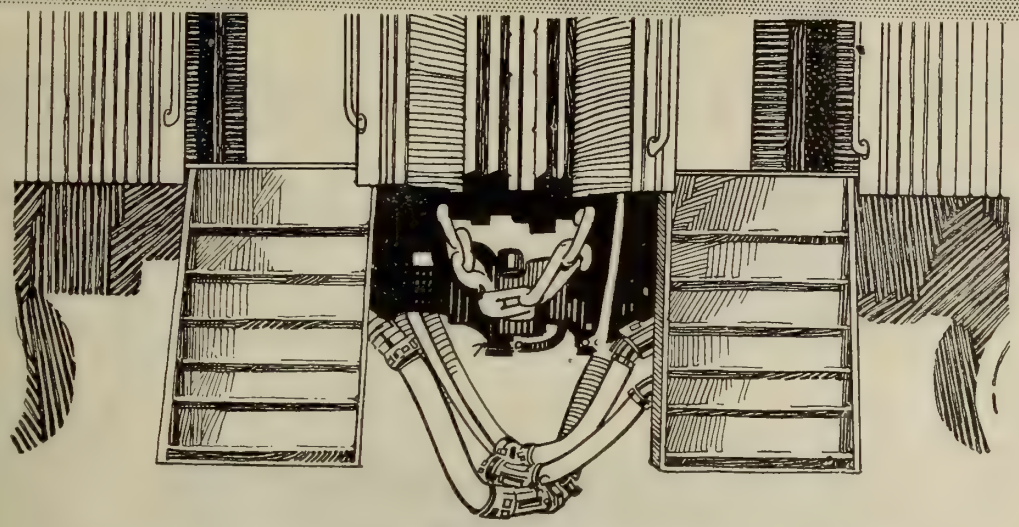

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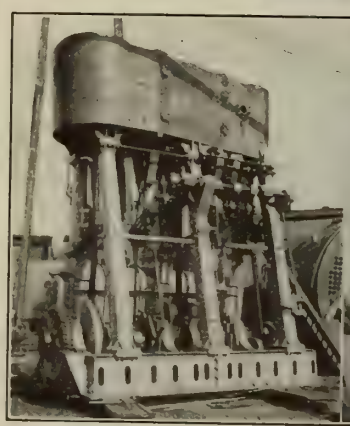

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MARINE ENGINEERING
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Vol. X. AUGUST, 1920 No. 8

Launching of Ships in Restricted Waters

Paper Read Before the Society of Naval Architects and Marine Engineers, New York, by Captain H. M. Gleason, and Lieutenant Commander H. E. Saunders, Both of the Construction Corps, U.S.N.

ALTHOUGH there have been ten papers read before this society giving notes and data on the launching of various types of ships, the subject of the launching of ships in restricted waters has not been touched upon. The authors therefore have undertaken to present this subject based upon the experience of the Mare Island Navy Yard.

Unfortunately there is very little definite information obtainable from text books, technical papers, etc., giving the results of actual launchings in which means to check the speed of ships have been used. It is therefore believed that the subject-matter of this paper will be a welcome addition to the already published data on launchings.

The launching of a large ship is attended with a certain amount of risk under the most favorable conditions, and when there is added to this the problem of checking the ship after leaving the ways, the anxiety of those responsible is not relieved until the ship comes to rest. In most shipyards in this country there is sufficient water space in wake of the building slips to allow the ship free scope, or at least sufficient water space to check the ship by the dropping of anchors. In some shipyards situated on narrow waters, the building slips are inclined at an angle of about 4½ degrees to give greater travel.

Various methods have been successfully used to check vessels on leaving the ways, such as the breaking of rope stops, the use of wood friction wedges, fitting of a mask on the stern, dropping of anchors, slewing the stern with the channel by dropping stern anchors and by chain drags.

Anchors are generally fitted for emergency use in connection with any of the above methods.

The most commonly used method, especially in English and Scotch shipyards, is the use of heavy chain drags. The amount of chain used varies according to the experience at the various yards, and depends upon the nature of the surface available for the drags, launching speed, etc.; but the usual weight of chain is about one-twentieth of the launching weight to bring the vessel to rest in from 200 to 300 feet after leaving the ways.

The large building slip at the Mare Island Navy Yard, is set nearly at right angles to the channel, which is 1,230 feet wide. It is therefore necessary to check any large vessel by other means than anchors, as the space available is not sufficient for direct checking or for slewing the stern. The Prometheus (fleet collier) was launched in 1908, using chain drags to stop her. Although the drags successfully stopped the vessel within 200 feet the work necessary to pile the chain, to completely clear the slip of obstructions (blocking, shoring, etc.), and finally to untangle the masses of chain, was extensive and costly. The next vessel launched (August, 1912), was the fleet collier Jupiter, of 19,000 tons loaded displacement, and 5,207 tons launching weight. The problem of stopping this vessel was gone into very carefully, and the final conclusion was to use chain drags. Friction brakes were considered, but the development of the idea at that time was not sufficient to warrant the trial. A description of the chain drags as used in launching the Jupiter will be of interest. In all, 390 tons of chain were used, coiled in fourteen coils ranging from 10 to 50 tons each, the smaller coils or drags being arranged to take up first in succession to minimise the danger of parting the cable, due to a too sudden stress. Seven piles of chain were placed on each side, connected up to three 2-inch (diameter) wire ropes attached to pads on the ship.

As a further precaution, two 3,000-pound anchors, one port and one starboard, were secured on the side of the ship at frame 136, each with 10-inch hawser stopped up at intervals and carried through stern chocks. One of these anchors was to be dropped on a signal given from the bridge should the drags fail to act. These anchors were intended to turn the stern up or down stream as seemed most expedient.

At the launch the actual velocity of ship at time of pivoting (also the maximum) was 16.2 feet per sec., and the velocity of ship when fully afloat was 15 feet per sec. The distance run after the first drag took up was 213 feet, and the total weight of chain drags actually brought into play was 290 tons, or one-eighteenth of the launching weight.

Early in 1913, in preparing for the launching of the next ship, the fleet oiler Kanawha, the development of friction brakes was actively taken up and experiments conducted which gave assurance of the practicability of friction brakes, using wire ropes passing through steel blocks under pressure. In the future design and development of these brakes advantage was taken of the data on this subject presented by Mr. A. Hiley, Associate Member of the Institute of Naval Architects, in a paper prepared by him and published in September, 1913, issue of "The Shipbuilder."

The launching weight of the Kanawha was estimated at 4,000 tons (actually was 4,100 tons), and it was therefore estimated from friction data obtained in experiments, that two launching brakes would be sufficient. A description of the launching brakes used and other precautions taken to check the ship is given as follows:

"The brakes were securely anchored on each side of the slip, 22 feet from the centre and about 80 feet aft from the bow. In each brake the friction length employed was 2-inch diameter steel wire ropes (6 strands of 37 wires each), 600 feet long wound on reels fitted with brakes placed about 50 feet from the brake. Springs tightened by screws produced the requisite pressure upon the ropes, which are gripped between grooves in the upper and lower steel castings. In order that the pressure applied by the tightening screws might bear equally on the two ropes, the upper casting is formed with a ridge at the centre to which the pressure is transmitted by beams formed of channel sections and plate. To regulate the pressure on the rope at will, three hand winches were provided and bull wheels fastened to the nuts over the spring washers. These were connected by a ⅜-inch (diameter) endless wire rope. The two friction cables were connected by a heart shackle to a single 2-inch (diameter) wire steel hawser, 560 feet long, which was shackled to a pad on the ship's side on line with the second stringer, the same arrangement being used on both sides of the vessel. To assist in stopping the vessel a mask was also fitted on the stern, 16 feet wide by 11 feet high, the

lower edge being 8 feet above the keel line. As a further precaution, a 11,000-pound anchor was secured on the port side of the ship, with a 10-inch hawser stopped up at intervals and carried to the stern bitts. This anchor was to be dropped upon signal given from the forecastle should the brakes fail to act, and was intended to turn the stern down stream. A 6,000-pound anchor was housed in the port hawse pipe and was to be dropped if it became necessary to hold the bow."

The results of the launching, as far as they concern the launching brake were as follows: Launching weight, 4,100 tons; maximum velocity, 16 feet per second; velocity when ship floats, 13 feet per second; total distance friction ropes were drawn through brakes before ship was stopped, 341 feet.

The same brakes and arrangements were used in launching the Maumee, a sister ship to the Kanawha. The results in the case of the Maumee were as follows: Launching weight, 4,370 tons; maximum velocity, 17.25 feet per second; velocity when ship floats, 14 feet per second; distance cables were drawn through brakes before ship stopped, 329 feet.

The same brakes, but without the stern mask were used in launching the Cuyama, a sister ship to the Kanawha and Maumee. The results in the case of the Cuyama were as follows:

Launching weight, 4.056 tons; maximum velocity, 16.7 feet per second; velocity when ship floats, 14.5 feet per second; distance cables were drawn through brakes before ship stopped, 444 feet.

By comparing the foregoing data the effect of the stern mask may be estimated as the Cuyama, without the mask and with a slightly greater velocity (when afloat) travelled 125 feet farther than the Maumee.

The action of the wire rope cables under pressure between the upper and lower cast steel brake blocks bears a very important part in the proper operation of this type of brake. There were no reliable data on the coefficient of friction under the actual working condition and no guide as to what type of wire rope was best suited to obtain the desired frictional resistance. These two questions were solved by numerous experiments, and actual trials on vessels launched.

As to the coefficent of friction, the figure given by Hiley in the article previously mentioned is 0.08. All available information in handbooks and experiments on a small scale indicated, however, that the coefficient of friction was much higher than this, presumably about 0.2. To check this figure and to test the apparatus, the hydraulic brake developed for the California was mounted on a temporary stand and run with full pressure, using one friction wire in one of the grooves. The coefficient of friction deduced from these experiments is about 0.24, and the results obtained indicate that this value remains practically constant for all loads and all speeds of the wire rope.

As to the type of wire rope to be used, it was obvious that the wire strands on the outside of the rope would have to lie exactly parallel to the axis of the rope in order to prevent "rifling." It was evident, after the first experiments, that the wire would score the grooves in the cast-steel blocks, but so long as the scores remained parallel to the blocks the action of the frictional pull on the wire ropes was entirely satisfactory, causing no unlaying or tightening up of the strands. There was some question as to whether a solid rope was necessary or whether a rope with hemp core would not be more suitable. The latter rope, being more elastic, is less likely to seize in the grooves, and for this reason has been used in all the launching operations with this brake. There had also to be considered the possibility of one or more strands breaking inside the brake and causing a jam. In this event the wire rope would likely be broken or the chain pendant to the ship carried away. During the several launchings, the outside wires in the strands have been perceptibly flattened by abrasion, but in no case has any strand parted or any wire rope jammed. In this connection it is interesting to note that the same wire ropes were used as friction ropes in the launching of three large ships, and now are in condition for use with at least as many more. From the experience gained at the Mare Island Yard the most satisfactory type of wire rope is 2-inch diameter, black, plow steel, 6 strand, 37 wires each, one hemp centre, ordinary lay and 137 tons breaking strength. Particular care was required under the specifications for the rope to have the individual wires in each strand laid parallel to the axis of the rope at the point of frictional contact.

In connection with the launching of the battleship California the number of brakes necessary was determined from the data and experience in the use of the brakes used in launching the Kanawha, Maumee and Cuyama. In these latter cases two brakes were used with satisfactory results. Therefore, by comparison of the relative launching weights and velocities, the number of brakes required for the California was ten.

It was also considered necessary to have more definite control over the pressure to be applied to the friction blocks, and the screw, nut and bull wheel scheme was abandoned for hydraulic cylinders and pistons, as shown in photographs and plans. The experiments conducted showed that two pressure cylinders were sufficient in lieu of three.

Although previous experience with these brakes was sufficient to determine the number to be required in launching the California, the exact pull required from the brakes, collectively and individually, and the actual force required to stop the ship were not definitely known. There were also other questions on which more complete information than was available was considered necessary, such as the actual pivoting point at various tides, the depth of water required to accommodate the deepest dip of the stern, the behaviour and clearance of the forefoot on leaving the end of the ways, etc. It was therefore decided to construct and try out a launching model based on the law of comparison similar to model tank experiments. This model could, therefore, be launched at will and as often as required, varying the conditions to suit those expected at the time of launching.

The model was constructed with a length ratio of 1:96 (scale ⅛-inch equals 1 foot), as giving a craft which was easy to handle, yet sufficiently large to make possible a fair degree of accuracy in the results. Briefly, the dimensions of the model are: Length, 6 feet 3 inches; beam, 12 inches; weight (approximate), 39 pounds. Material—wood, hollow, finished in spar varnish. The displacement, longitudinal position of centre of gravity and longitudinal moment of inertia may be varied at will.

The tank and framework supporting it require no special comment. Fresh water is used, and the contour of the river bed is represented by a layer of gravel and sand on the bottom of the tank. The water area represents the width of the channel, 1,230 feet, by a certain portion of its length, 320 feet. A modified form of hook gauge records the tide level in feet and tenths. The ground ways (with camber), the ship, the coffer-dam bulkheads, crane piers, etc., are of course, all reproduced exactly to scale. To obtain correct results by the method of comparison, it is necessary for the model to run off the ways and through the water at its "corresponding speed." By running on a system of rails and steel wheels with hardened pivots it was possible for the model to accelerate itself at the required rate without the application of any external force. A central rail under the keel of the model runs on two large flanged wheels, one under the vessel and one at the end of the ways; two wheels at the fore poppets run on two rails, which represent the ribbands of the ground ways. This system of mounting the model on three points was suggested by Mr. Percy A. Hillhouse and Mr. Wm. H. Riddlesworth in a paper presented by them at the fifty-eighth session of the Institution of Naval Architects, March 29, 1915, as being decidedly preferable to mounting on six wheels, especially when the ways were cambered. The forward keel wheel of the California model supports the weight until the keel track reaches the after keel wheel; the latter then supports the weight until the model pivots, when a special releasing device drops it clear of the forefoot, as the model leaves the ways.

Although not shown on the photographs, the tumbling shores, cribs, wedges, cable reels and brakes were later added to the model, in order that launching drills might be held at the model and the various gangs acquainted with their duties and the sequence of operations. A small brass-preventer dog shore and a set of solenoid-operated mechanical triggers represent accurately the dog shores and hydraulic triggers on the ship. Two

brass trimming masts, with pencils attached, erected at the forward and after perpendiculars, record the traces of the bow and the stern at all points of the launching operation.

A special recording mechanism was designed and built to record simultaneously all data, and to make the model as nearly as possible automatic in its operation. Reference to the photographs will indicate the general arrangement of this machine. Without undue elaboration of details, the construction and operation of this mechanism may be described briefly as follows:

A small cord (or cable, as it will hereafter be called) is fastened by a wire hook to an eye plate in the bow of the model at the 16-foot water line. This cable is led forward over an aluminum idler pulley carried on a swinging frame and then back and around a small drum about 1½ inches in diameter. Sufficient cable can be wound in a single layer on this drum to permit the model to run to the far end of the channel. The drum has two silver contacts on a small commutator, and acts therefore as a chronograph, giving two marks per revolution on the recording paper. A standard navy mean time break-circuit chronometer indicates seconds on the recording paper (by means of suitable solenoids and pencils) as a reference for the chronograph readings. The recording paper is that supplied for the Burroughs adding machine; it is drawn at constant speed over the paper table by two rubber rollers geared to a small d.c. motor. A small controller with adjustable segments, also driven from this motor, controls the current to the solenoid triggers and to the tripping coils of the brakes; this controller switches on and off the motor and other solenoid circuits and renders the mechanism entirely automatic in its operations. As the entire launch consumes only seven or eight seconds, it is not practicable to arrange for manual operation in this connection.

The launching brake mechanism, also to be briefly described, does not, of course, operate in exactly the same manner as the brakes on the full-sized vessel. The small drum upon which the cable is wound is constructed with heads of highly polished steel. Cork insert brakes, carried on swinging plates, bear against the heads of the cable drum and serve to retard the angular motion of the latter, when the brakes are applied. A small coil spring holds the plates clear of the drum when the brakes are to run free.

The weight carriers and weights are released by solenoid operated triggers; pistons on the weight carriers work in oil dashpots so as to prevent vibrations of the brake recording pencil, and pistons may be changed so as to give a sudden or gradual application of the brakes as desired.

The cable pull exerted on the model by the brakes is recorded as follows: The aluminum idler pulley carries the bight of the cable which is attached to the model and being unwound from the drum. Any retardation of the drum, as the cable is being paid out, exerts at once a pull on the model, and the combined action of these two forces causes the swinging arm to move. The angular motion of the latter is, however, controlled by the action of two balanced springs at the lower end of the arm; whatever movement takes place is proportional to the resistance of the brakes and is recorded on the paper by a pencil attached to the extreme upper end of the arm. The entire mechanism is accurately calibrated in such a manner that all errors due to angularity, inequalities in the springs. etc., are entirely eliminated.

A short account of the sequence of operations during a launch may serve to explain more clearly the exact method of recording the desired information. Assume, first, that the model has been released and is moving down the ways; the cable is paying out freely as the only resistance is that of the small brake on the chronograph segments.

1. At the designated moment, the controller operates the brake release and allows the weight carrier and weights to drop.

2. The weight carrier, acting through the cords, causes the brakes to grip the revoving drum.

3. The latter, although continuing to revolve and to act as a chronograph, is retarded somewhat by the action of the brake.

4. A pull is exerted on the cable, which, leading around the idler pulley so as to effect a change of direction of 180 degrees, draws the latter toward the model against the action of the double springs.

5. The pencil attached to the arm records the cable pull on the moving paper strip, while a stationary pencil traces at the same time a zero or reference line.

From what has been said in the preceding paragraphs, it will be evident that all elements of the launching conditions may be varied at will, using the apparatus to record all the data for successive series of runs. The various unknown factors are then determined as described below. With regard to the actual performance of the model, it may be said that all parts of the mechanism functioned in a most satisfactory manner, and that the results for corresponding and similar runs were remarkably consistent.

To work up the results, it is of course necessary to apply the principles of mechanical similitude as is done for all work in the model basin.

The length ratio, L being 96, the corresponding speed ratio is $\sqrt{L} = \sqrt{96} = 9.798$. Inasmuch as the maximum launching speed of the model is about 3 feet per second, corresponding to a ship speed of 29 feet per second, and as the vessel in any circumstances would never attain such a high velocity means are adopted to reduce and regulate this velocity to correspond with what may be reasonably expected on the day of the launch. A short length of cord is attached to the model and drawn through an improvised friction brake, the length of cord being varied to suit the final launching velocity required. As the effect of this retardation is only to reduce the initial velocity, and as this action ceases long before the brakes are applied, it need not be considered except when determining the shape of the entire velocity curve. The final speed (when entering the water) may be varied in this way from 12 feet to 24 feet per second.

The chronograph is so proportioned that each of the intervals between record marks represent about 19.2 feet travel of the vessel. For the sake of convenience, all units, unless otherwise noted, will hereafter be expressed in proper terms for the full-sized vessel. All calculations and curves have been worked up on this basis, as the work is then more easily followed by all concerned.

The length ratio, L, as noted above, is 96.

The displacement ratio is therefore $L^3 = 884{,}736$. For a weight of ship and cradle of 16,000 tons, this corresponds to a model weight of 40.52 pounds.

The ratio of cable pull on the model and brake pull on the ship is also L^3, or 884,736. (From the theory of mechanical similitude, where $f \times s = \frac{1}{2} mv^2$.)

A pull of 500,000 pounds on the ship is equivalent to a pull on the model cradle of 9.042 ounces, which, in turn, is represented by an ordinate of 0.81 inch on the recording paper. The model brake is capable of exerting a total relative pull of about 900,000 pounds, or some 400 tons.

The brake mechanism has been calibrated with extreme care, using a specially constructed and calibrated spring to exert a tension upon the cable in its normal direction, with the brakes set and the recording mechanism in operation. After repeated measurements of the resistance, due to the rotation of the drum, the rotation of the idler pulley and the friction of the pencils on the trimming masts, it has been assumed that this resistance may be neglected, as being within the limits of accuracy of the observations as a whole.

In order that the traces of the bow and stern may be correct in shape, it is necessary that the moment of inertia of the model about a transverse horizontal axis through its centre of gravity should bear the proper relation to that of the large vessel; that is K, the radius of gyration, should vary as L. To this end, the model is suspended by two cords of known length equidistant from the centre of gravity, and K determined in the usual manner. The inside lead ballast weights are then placed in such a position as to fulfil the required conditions. It is understood, of course, that K for the large vessel must be found by more or less approximate methods. The pivoting point, the drop of the bow, the clearance of bow and stern, the final trim afloat and the position of the model when it comes to rest are easily obtained from the record of the trimming masts. The time and point of application of the brakes are indicated on the recording strip as shown on the plan.

In the figures presented by Mr. Hiley

in his paper on the launching brake, the water resistance is assumed to absorb about 20 per cent. of the total energy of the vessel. This figure is necessarily quite approximate, for reasons stated at the beginning of this paper, and an attempt has been made at this point to arrive at a more definite value of this quantity. As is well known, the water resistance of the vessel during launching can be represented by the equation $Rw = K^2V^4$, provided the cradle and other fittings are of such shape as to produce wave-making resistance only. This is not exactly the case, however, as the skin friction resistance is a considerable portion of the whole; the water resistance is best represented, therefore, by a simple equation of the form $Rw = K^2V^3$. Although this equation, as it stands, does not conform exactly to the theory of mechanical similitude, it is used here as a means of simplifying the work. To translate model resistances into ship resistances would require an excessive amount of work, if this operation were to be carried out exactly as is done at the Model Basin.

By substitution and integration of the equation $Rw = K^2V^3$, we find that the velocity-distance curve is represented by the following equation:

$$V = \frac{M}{K_2 S} = \frac{K_1}{S}.$$

Where V is the velocity and S the distance run, measured from a certain origin K_1 and K_2 are constants. The value of K_1 for this hyperbolic curve may be found by solving two simultaneous equations representing two points on the velocity curve where the vessel is clear of the ways and running freely.

The curve of velocity thus obtained is only approximate, but it agrees closely with the curve as actually recorded, and it forms a very convenient means of computing the water resistance during the period when the ship is being brought to rest by the brakes.

The first equation indicates that the ship, leaving the ways and neglecting the effects of wind and tide, would still have a certain velocity per second after a certain distance. The second equation enables us to plot the curve of water resistance. When integrated, the curves give the following results for this particular case:

	Ft.-lbs.
Total energy absorbed by water resistance	66,740,000
Total energy absorbed by brake resistance	138,360,000
Total energy as recorded from curves	205,100,000
Kinetic energy of vessel traveling at 19.4 ft. per second, when brakes are applied	201,600,000
Difference	3,500,000

Representing an error or discrepancy of less than 2 per cent.

Note that in this case the resistance of the water absorbed about 32½ per cent. of the total energy.

Inasmuch as the results are obtained by entirely independent methods, the check is very positive and the agreement remarkably close. The curve of brake pull is considered so reliable, that, from data on similar mode runs to be made just before the launch, the pressure in the hydraulic brake cylinders and the point of application of the brakes will be determined.

For purposes of comparison, the velocity-distance curve of the Cuyama has been added. The similarity between this curve and the one obtained from the model is most apparent.

It has been necessary, throughout this paper, to comment rather briefly upon what is really a very comprehensive subject, and it has been the intention to supplement this brief description with such photographs and plans as would serve to explain clearly the subject matter of this article. Unfortunately, at the time this paper was prepared, the launch of the battleship California had not taken place, and it was not possible to make extended comparison of the data obtained from the model and the final data from the actual launch. It is hoped that, when this matter has been worked up, there will be further opportunity to present it to the society in a subsequent paper.

THE LATEST DESTROYER

Messrs. J. Samuel White & Co., Ltd., the well-known shipbuilders and engineers of East Cowes, Isle of Wight, completed and delivered their 122nd steel war vessel and 74th steel torpedo craft on Tuesday, July 27. This was H.M.S. Wolverine, the most modern, most powerful and most up-to-date type of destroyer in existence. Of the Admiralty "V" class, she was laid down on October 18, 1918, and launched July 17, 1919, and is a similar vessel in every way to H.M. Ships Wivern, Witherington, Winchester, and Winchelsea, also built by the firm and now serving in the Royal Navy. After completing with stores at Portsmouth, she will join the 3rd Destroyer Flotilla of the Atlantic Fleet.

Her full power trials off the south coast of the Isle of Wight were entirely satisfactory, when she attained an average speed of between 34 and 35 knots. The Wolverine's twin screws are driven by a double set of Brown-Curtis geared turbines, and Michell thrust blocks have been installed. Steam is generated in three Admiralty type water tube boilers. These together with the oil fuel burning installations, all auxiliary machinery, and the entire equipment have been installed by the builders. The ship is capable of carrying some 400 tons of oil fuel, which will enable her to run about 1,000 miles at full speed. Like the other destroyers of her class the Wolverine's armament consists of superimposed 4.7-inch guns fore and aft, with fire control and director gear; two anti-aircraft high angle quick firing guns on an elevated platform amidships, and two sets of triple torpedo tubes mounted on revolving platforms. As is customary with all White-built destroyers the living accommodation for officers and crew surpasses that of most destroyers, the firm having consistently made this a special feature of their construction.

The name, Wolverine, has been borne by the navy at different times. The last Wolverine was a destroyer of the Basilisk class, built in 1919, by Cammell Laird. She took part in the Gallipoli campaign, and was lost in collision off the Irish Coast on December 12, 1917. Whereas she had a speed of only 27 knots, the new ship steams at anything between 35 and 40 knots. Among other war vessels which have been known by this name are a gunboat barque rigged, purchased as the Rattler from Captain Schanks, of London, in 1798, and commanded by the famous Captain Lewis Mortlock; a sloop built at Topsham under contract by Mr. Owen in 1805 and sold out of the navy in 1816 for £810; a 16-gun brig built at Chatham in 1836 and lost in the West Indies in 1855, the wreck being sold at Jamaica in 1857 for £20; and another vessel which was built at Woolwich in 1859-1860. It is recorded that the above-mentioned barque (13 guns) on September 9th, 1799, captured the Dutch Gier (14), and with the sloop Arrow (24) also captured the Dutch Draak (24).

BOOK REVIEW

We have received a copy of Green's Marine Directory of the Great Lakes for the year 1920. The volume is well illustrated and contains a great amount of useful information on ships and shipping of the inland waters. The early pages of the book are devoted to an alphabetical list of owners and managers of vessels, both U. S. and Canadian, trading on the lakes. A list of stations where storm warnings are displayed follows, and a register of Great Lakes vessels. This register gives the name, gross tonnage, material hull is built of, capacity, general dimensions, number and size of hatches, compartments, tanks, etc. A list of car ferries and a list of passenger boats is included. A useful feature is a list of changes of names of vessels, giving past and present names. This is a book which is to the Great Lakes shipping what Lloyd's Register is to the world's shipping, and should be in the possession of every one interested in inland navigation.

Mr. Walter Lambert, naval architect and marine surveyor of 14 Place Royale, Montreal, has undertaken the Canadian agency of Messers Cochran & Co., Ltd., of Annan, Scotland, makers of the well-known Cochran donkey boiler, oil or coal-fired. Mr. Lambert has also opened an office at 408 Bower Bldg., Vancouver, to look after his interests on the Pacific Coast.

LLOYD'S REGISTER SHIPBUILDING RETURNS FOR QUARTER ENDING JUNE 30

A very interesting summary respecting the world's output of shipbuilding for the quarter ended June 30, 1920, has been compiled by Lloyd's Register of Shipping and is given below. It should be noted that warships are not included in these returns. Complete totals for Germany are not yet available; therefore no figures are shown for that country.

The merchant tonnage building in the United Kingdom at the end of June, 1920, viz., 3, 578,153 tons, shows an increase of 184,000 tons as compared with March, 1920, and is 1,054,000 tons more than the work in hand 12 months ago.

The largest increase has taken place on the Clyde, where there are now 1,-260,777 tons under construction.

The total "commenced" during the quarter amounts to 588,604 tons, and includes many large vessels. There are now building 223 vessels of 6,000 tons and upwards as compared with 210 at the end of March. The vessels of 10,-000 tons and upwards amount to 63.

The output during the quarter shows an increase of about 69,000 tons as compared with that of the previous quarter.

The total merchant tonnage building abroad — 4142,751 tons — is about 405,000 tons lower than the total building at the end of March; this is due to the arge decrease in the tonnage building in the United States—467,000 tons less than at the end of March.

An enormous decrease has taken place in the tonnage under construction in the United States during the last 15 months. At the end of March, 1919, 4,185,525 tons were actually building in that country, which total by the end of June, 1920, has been practically reduced by half, while in the United Kingdom during the same period the figures have increased from 2,254,845 tons to the present record total of 3,578,153 tons, an increase of nearly 60 per cent.

The figures for the British Dominions are about 36,000 tons and those for Holland 32,000 tons higher than at the end of March, while in Japan there is a decrease of 31,000 tons.

The world's total—7,720,904 tons — is about 221,000 tons lower than the figures for March, and 328,000 tons lower than the "record" figures reached at the end of September, 1919.

The tonnage of vessls actually building under the supervision of the Society's Surveyors, and intended to be classed with Lloyd's Register amounts to 4,930,340 tons, viz., 2,797,031 tons in the United Kingdom and 2,133,309 tons abroad.

The following figures show the merchant tonnage building in the world six years ago, namely, at the end of June, 1914, may be of interest for comparison with the present totals:—Building in the United Kingdom, 1,722,124 tons; building abroad, 1,440,766 tons, total for the world, 3,162,890 tons, of which 1,865,337 tons were building under the supervision of Lloyd's Register.

It will be noticed that as compared with the present totals the United Kingdom tonnage is 1,856,029 tons higher, the tonnage building abroad shows an increase of 2,701,985 tons, and the total tonnage building under the Supervision of Lloyd's Register has increased by 164 per cent.

MERCHANT VESSELS UNDER CONSTRUCTION

The returns compiled by Lloyd's Register of Shipping, which only take into account vessels of 100 tons gross and upwards, the construction of which has actually been commenced, show that there were 941 merchant vessels of 3,-578,153 tons gross under construction in the United Kingdom at the close of the quarter ended June 30, 1920. The particulars of the vessels in question are as follows, similar details being given for the preceding quarter and for June 30, 1919, for the purpose of comparison:—

Description	June 30, 1920 No.	Gross Tons	Mar. 31, 1920 No.	Gross Tons
Steel	888	3,563,251	814	3,379,731
Ferro-Concrete	3	860	7	1,401
Wood & Composite	4	1,799	4	1,799
Total	895	3,565,910	825	3,382,931
Sail—				
Steel	41	9,469	35	8,451
Ferro-Concrete	3	2,174	4	2,854
Wood & Composite	2	600	1	189
Total	46	12,243	40	11,494
Total Steam & Sail	941	3,578,153	865	3,394,425

The tonnage now under construction in the United Kingdom is about 184,000 tons more than that which was in hand at the end of last quarter, and about 1,054,000 tons more than the tonage building 12 months ago.

Of the merchant vessels being built in the United Kingdom at the end of June, 711 of 2,-797,031 tons are under the inspection of the Surveyors of Lloyd's Register with a view to classification by this society.

MERCHANT VESSELS UNDER CONSTRUCTION IN THE WORLD

Where Building	Steam No.	Gross Tons	Sail No.	Gross Tons
United Kingdom	895	3,565,910	46	12,243
*Other Countries	1,132	4,084,817	122	57,934
Total for the World	2,027	7,650,727	168	70,177

*Excluding Germany, figures for which country are not yet available.

SIZE OF VESSELS UNDER CONSTRUCTION

The following table shows the vessels under construction in the United Kingdom classified according to gross tonnage:—

Gross Tonnage	Number Steam	Sail
*100 and under 500 tons	181	38
500 " 1,000 tons	84	8
1,000 " 2,000 tons	98	—
2,000 " 3,000 tons	79	—
3,000 " 4,000 tons	85	—
4,000 " 5,000 tons	58	—
5,000 " 6,000 tons	87	—
6,000 " 8,000 tons	100	—
8,000 " 10,000 tons	60	—
10,000 " 12,000 tons	9	—
12,000 " 15,000 tons	31	—
15,000 " 20,000 tons	20	—
20,000 " 25,000 tons	3	—
25,000 " 30,000 tons	—	—
30,000 " 40,000 tons	—	—
40,000 tons and above	—	—
Total	895	46

*Vessels of less than 100 tons are not included in Lloyd's Register Shipbuilding Returns.

WORK IN HAND IN PRINCIPAL DISTRICTS

The following table gives the total figures for vessels now under construction in the principal shipbuilding districts of the country, as compared with those for the last quarter. Each district of course includes places in the neighborhood of the port after which it is named.

District	Descrip.	June 30, '20 No.	June 30, '20 Gross Ton'ge	Mar. 31, '20 No.	Mar. 31, '20 Gross Ton'ge
Aberdeen	Steam.	21	119,743	20	13,509
	Sail...	—	—	—	—
	Total..	21	119,743	20	13,509
Barrow, Maryport & Workington	Steam.	14	131,510	14	118,990
	Sail...	—	—	—	—
	Total..	14	131,510	14	118,990
Belfast	Steam.	47	337,070	39	336,250
	Sail...	2	1,000	4	2,000
	Total..	49	338,070	43	338,250
Clyde—					
Glasgow	Steam.	174	868,653	172	805,171
	Sail...	25	5,694	27	5,851
	Total..	199	874,347	199	811,022
Greenock	Steam.	75	386,430	74	367,670
	Sail...	—	—	—	—
	Total..	75	386,430	74	367,670
Dublin	Steam.	10	13,225	9	13,208
	Sail...	—	—	—	—
	Total..	10	13,225	9	13,208
Dundee	Steam.	21	62,380	17	51,800
	Sail...	—	—	—	—
	Total..	21	62,380	17	51,800
Hartlepool	Steam.	21	98,880	19	89,140
	Sail...	—	—	—	—
	Total..	21	98,880	19	89,140
Hull	Steam.	61	70,499	58	78,168
	Sail...	—	—	—	—
	Total..	61	70,499	58	78,168
Leith	Steam.	27	65,548	25	64,325
	Sail...	—	—	—	—
	Total..	27	65,548	25	64,325
Liverpool	Steam.	67	118,742	45	106,125
	Sail...	2	1,494	2	1,494
	Total..	69	120,236	47	107,619
Londonderry	Steam.	4	28,000	3	21,000
	Sail...	—	—	—	—
	Total..	4	28,000	3	21,000
Middlesbro', St'kt'n&Whitby	Steam.	55	248,480	47	216,430
	Sail...	1	680	2	1,360
	Total..	56	249,160	49	217,790
Newcastle	Steam.	129	650,169	122	629,408
	Sail...	—	—	—	—
	Total..	129	650,169	122	629,408
Newport, Mon.	Steam.	9	41,274	11	47,727
	Sail...	—	—	—	—
	Total..	9	41,274	11	47,727

Southampton	Steam.	30	51,451	25	45,227
	Sail...	4	600	5	789
	Total..	34	52,051	30	46,016
Sunderland	Steam.	70	329,503	75	346,215
	Sail...	—	—	—	—
	Total..	70	329,503	75	346,215

Other Details

The following details concerning the shipbuilding work of the United Kingdom during the past three months may be added:—

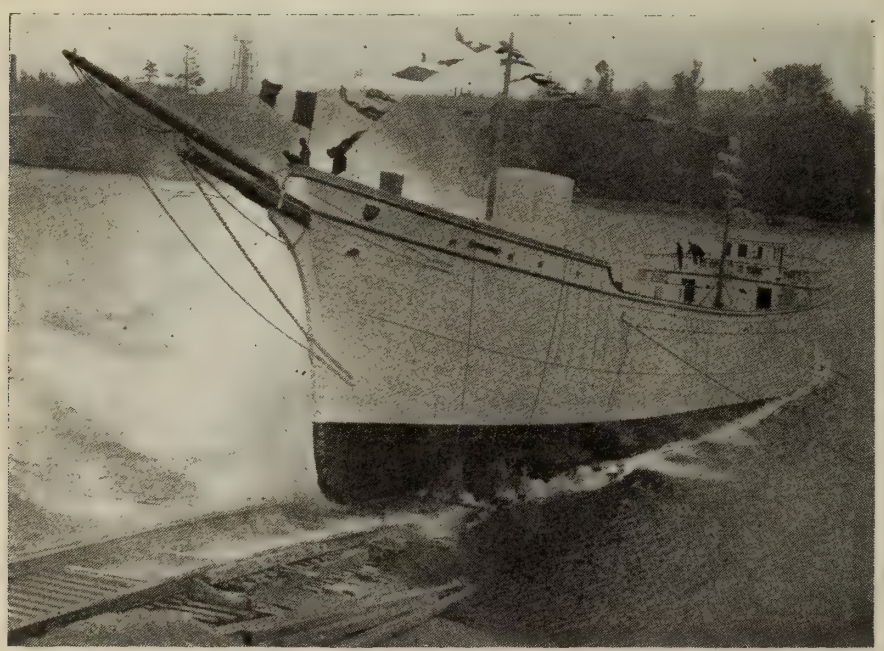
During quarter ended June 30, 1920	Steam No.	Steam Gross tons	Sail No.	Sail Gross tons
Vessels commenced	220	584,829	14	3,775
Vessels launched	154	518,568	11	4,375

MERCHANT VESSELS UNDER CONSTRUCTION ABROAD

Countries	Steamers and Motor Vessels. Steel No.	Steel Gross Tons	Wood No.	Wood Gross Tons	Sailing Vessels. Steel No.	Steel Gross Tons	Wood No.	Wood Gross Tons	Total No.	Total Gross Tons
America—										
United States—										
Atlantic Coast	230	1,352,750	6	4,800	14	6,156	12	9,950		
Gulf Ports	37	181,841	8	16,060	1	4,074	1	400	414	2,105,956
Pacific Coast	69	423,124	4	8,400	..	....	2	3,200		
Great Lakes	30	95,201	..	.....	..	....	..	....		
British Dominions—										
Canada—										
Great Lakes	18	40,891	..	.....	..	....	..	....		
Coast	40	150,450	12	10,469	..	....	14	7,595	115	268,799
Other Dominions	20	53,464	1	450	..	....	10	5,480		
Belgium	6	24,210	..	.....	..	....	..	....	6	24,210
Brazil	..	.....	2	3,196	..	....	..	....	2	3,196
China	7	29,850	..	.....	..	....	..	....	7	29,850
Denmark	59	117,389	3	1,050	..	....	..	....	62	118,439
France	88	263,319	..	.....	1	435	6	1,548	95	265,302
*Germany	..	.....	..	.....	..	....	..	....	..	.....
Greece	1	900	1	600	..	....	..	....	2	1,500
Holland	152	398,465	..	.....	1	450	..	....	153	398,915
Italy (in. Trieste)	65	316,508	52	23,630	2	550	47	13,226	166	353,914
Japan	56	254,260	..	.....	..	....	..	....	56	254,260
Norway	51	83,978	12	3,101	..	....	1	500	64	87,579
Portugal	..	.....	..	.....	..	....	6	3,500	6	3,500
Spain	30	99,682	2	1,600	..	....	1	150	33	101,432
Sweden	62	122,405	8	2,774	..	....	3	720	73	125,899
Total....	1021	†4,008,687	111	76,130	19	‡11,665	103	46,269	1,254	4,144,751

*The figures for this country are not yet available. †Including 11 ferro-concrete vessels of 27,618 tons. ‡Including 1 ferro-concrete vessel of 250 tons.

The tonnage being built in the world at the end of June under the inspection of the Surveyors of Lloyd's Register, excluding vessels the construction of which has not actually been commenced and excluding all vessels of less than 100 tons, amounts to 4,930,340 tons.



LAUNCH OF THE SCHOONER "LEON L."

SOREL SHIPYARD HAS LAUNCH

There was lately launched at the shipyards of The Transportation & Shipping Co., Ltd., at Sorel, Quebec, the first six wooden schooners of 1,300 tons D.W. which they are completing for their own account. The vessel was named "Leon L," by Madame J. L. Lachance, wife of the president of the company, and was blessed by Mr. Chanoine Bernard, Cure of the Parish of Sorel, in the presence of a very large company.

The names of the group in the second photograph reading from left to right are Mr. J. D. Chenier, accountant, Mr. J. L. Lachance, president and general manager, Mr. F. Bridges, engineer in charge, Madame J. L. Lachance, Rev. Cure Bernard, Mr. J. E. Lachance, Miss Lachance and Mr. G. I. Lachance.

The dimensions are 188 feet by 36 feet by 17 feet 6 inches moulded, with a carrying capacity of 1,300 tons on Lloyd's freeboard. The vessel will be rigged as a fourmasted fore and aft topsail schooner, with auxiliary motor power being fitted with twin screw "Skandia" oil engines of 120 B.H.P., each engine giving a speed of between 6 and 7 knots. There is a donkey boiler of "Cochrans" make with a heating surface of 400 sq. ft., 3 Clarke Chapman winches with 7 inches by 12 inches cylinders made by Canadian Vickers and a direct grip steam windlass. There are also a bilge and fibre steam pump and a feed pump for the donkey boiler, the fire and bilge pump can also be worked by compressed air from the auxiliary compressor. The vessel which will be completed by end of July will carry lumber from Canadian ports to the French colonies. The second vessel is to be launched before the end of the month.

$2,000,000 TO CONVERT "AQUITANIA"

At the recent annual meeting of the Cunard Steamship Company, the chairman, Sir Alfred Booth, spoke of the conversion of the "Aquitania" from coal to oil burning. The amount set aside to cover this cost is £400,000 or approximately $2,000,000: Sir Alfred said that the company, of course, expected to be recouped for this great outlay by the increased earning capacity of the vessel.

It is interesting to note that the cost of converting one vessel from coal to oil burning is equal to the cost of two complete vessels of 5,000 tons weight at $200 per ton; the average cost of the Canadian Government steamers.

Once every year a rather quaint ceremony is observed at Greenwich Observatory. An inspection of the Observatory is made by a "Board of Visitors" to whom the Astronomer-Royal presents a report on the work of the preceding twelve months. The latest report shows that although the Observatory was founded centuries ago, at the very dawn of scientific navigation, it keeps in line with the latest developments. A new aerial has been erected to extend the range over which wireless time signals can be received. These signals are now received regularly from the Eiffel Tower, Nauen, and Annapolis. The Observatory also controls the operation of time-balls in different parts of the country. These time balls are hoisted on a prominent mast and released at specific hours by an electric signal from the Observatory. The accuracy of the operation is checked by a return signal from the distant time-ball. Greenwich also controls "Big Ben," the famous clock of the Houses of Parliament.

High Speed Vessels During the War*

The Author Speaks of Conditions Governing the Design of High Speed Vessels, and Shows the Various Steps in the Development of This Type of Craft.

By W. W. MARRINER

*Paper read before the Institution of Engineers and Shipbuilders in Scotland.

TO be able to move quickly, apart from its utility, has always a charm, and the advantages of high speed in warfare are so evident that it is hardly necessary to emphasize them. A higher speed than that of the enemy gives the advantage of position, and also the power of accepting battle or not, so that full advantage may be taken of any superiority in armament, or if the enemy has the more powerful weapons it is possible to keep out of his way.

Speed, however, cannot be obtained without paying the price, and whether it is the rate at which one lives, or the speed of an express train or the speed of a vessel, in every case something has to be sacrificed in order to obtain what is desired. The amount of energy at our disposal is limited, and if we want to move quickly we must reduce the resistance to a minimum and utilize the maximum energy.

I have had the honour of being associated with Messrs. Yarrow during the whole of my career, and consequently my description in this paper of high-speed vessels is limited to what has been accomplished by this firm. I am quite sure that Sir Alfred Yarrow and Mr. Yarrow would be the very last to refuse a tribute to what has been done by other firms and individuals in the development of high-speed vessels.

One of the most renowned firms in this country is that of Messrs. Thornycroft, and the development of high-speed vessels owes much to the bold advances which have been successfully made by that firm from time to time, both in design and in taking advantage of the best available materials. Not only did they build many high-speed destroyers during the war, but they evolved a most successful high-speed coastal motor boat. The feats accomplished by these coastal motor boats are some of the most remarkable of the war. Any results which may have been obtained by them are, in the first instance, due to the skill and endurance of the officers and men of the Navy, but Messrs. Thornycroft deserve the highest praise for designing and building such wonderful craft.

Mention might also be made of the splendid work done in the early days by M. Normand, the great French designer, our friend and rival. As an instance of business chivalry it might be of interest to you to relate an incident which happened many years ago when rivals were struggling to be the first to obtain 30 knots, and in the end it came to a neck and neck race between the firms of Normand and Yarrow. The Yarrow boat was finished first, and on trial obtained the coveted speed of 30 knots. Concerning this performance the first congratulatory telegram received by Messrs. Yarrow was from M. Normand, and it is a telegram which we prize more than any other received at the time.

The title of the paper is "High-Speed Vessels during the War," and this enables me to draw attention to the splendid work done by passenger vessels, by high-speed steam yachts, by racing vessels of all kinds, and by hydroplanes, and it will be agreed that the lessons learned in some of these sporting vessels have advanced our knowledge in a most useful way.

In acknowledging the magnificent work which has been achieved by other fields of industry, such as steelmakers, builders of destroyers, the worker in science, and the pioneers in the various makers of turbines, and makers of auxiliary machinery, should not be forgotten, all of whom have contributed to making high-speeds possible.

In the design of a high-speed vessel it is necessary to make a careful study of the conditions under which she has to operate. A vessel for a shallow river is quite a different proposition from a vessel operating at sea, and again a high-speed vessel which has to operate on a short radius of action is very different from one which has to operate at a great distance from its base. The governing principle, however, remains the same, namely, resistance must be reduced to a minimum and power must be obtained most efficiently.

Consider, first of all, the question of weight, which is a large factor in resistance. It may be divided into weight of hull, weight of machinery, weight of crew and armament, and weight of fuel. The weight of armament is fixed by the military authorities (especially those of the enemy) as it is useless to get into a position to strike a blow, unless on arrival the blow can be made effective.

The total weight is largely influenced by the all-important consideration of cost. Having determined the total displacement it is then possible to allocate what weight can be allowed for the hull and for the machinery respectively. If the vessel has only to make short raids and return immediately to her base, then it is obvious that the scantlings of the hull and the accommodation for the crew can be reduced, because the vessel can choose the weather in which she puts to sea, and the crew can put up with a fair amount of hardship for a short period.

In the late war the Germans made full use of this condition, and their destroyers used to put to sea with a minimum of fuel and outfit on board, with the consequence that in many cases they were able to outdistance British vessels which had naturally to be prepared for keeping the sea for an indefinite period in all kinds of weather.

Generally speaking, in the modern destroyer the distribution of weights is approximately as follows:—

	Per Cent.
Weight of hull	35
Weight of machinery	35
Weight of armament and stores	7
Weight of fuel	23

Having settled the weight which can be allowed for the hull, one can decide the dimensions of the vessel. For speed the important dimension is the length, for stability the important dimension is depth. The length is, therefore, influenced by its relation to the beam and depth of the vessel, and it is here where the skill of the naval architect is shown by obtaining the very best compromise as regards the dimensions to be adopted, always keeping in view the special service for which the boat is to be employed. A vessel which has to be constantly employed with a fleet, and whose speed is determined by the senior officer of a larger ship, should be made stronger than the vessel, which will only have to act independently or with vessels of its own class, when the senior officer of the flotilla is himself experiencing the shocks caused by waves. Even in a comparatively calm sea there is a certain speed for every vessel where the synchronism of the waves with pitching might become serious.

Much can be done by arranging weights relatively to the buoyancy at any part, so as to reduce the bending moments, and present-day lightness in hull construction has been attained without any sacrifice of strength or decreasing the factor of safety, by a scientific study of the stresses involved and the best disposition of the material.

Having decided upon the dimensions of the vessel, the next important consideration is the form of the under-water hull, and in this connection tank experiments are valuable; in fact, essential. One can hardly believe that twenty

years ago it was necessary to go to Germany in order to have tank experiments carried out, although there were private tanks in this country which, however, were not available for public use. The form of the vessel is important not only from the point of view of reducing the resistance of the hull to a minimum, but also to ensure that the propeller works with the highest possible efficiency. From tank experiments it is possible to form a close estimate of the power required to drive the vessel, and for a given speed it is just as important not to over-estimate the power as it is not to under-estimate it, because the weight of the machinery may be taken to be proportional to the power, and excessive weight of machinery means a load to be carried increasing also the weights of the hull, and thus doubly reducing the speed.

Possibly sufficient attention has not been paid to the underwater form from the point of view of obtaining the highest propeller efficiency, especially in vessels where the power is proportionately very large. It is well known that at high speeds the propeller is one of the most inefficient parts of the propelling installation. Models have been equipped with propellers driven by motors installed on the model and a measure taken of the power required by the motors. Naval architects in this country at one time would not place much reliance on results obtained in this way, but owing to the researches carried out by Mr. R. E. Froude at Haslar, and Mr. Baker at the William Froude National Tank, Teddington, means have been perfected by which accurate investigations can be made, and experience has proved that the methods adopted by them are sufficiently accurate to form a reliable guide. As long ago as 1903 Sir Alfred Yarrow advocated a flat-bottom stern for a destroyer in order to increase the propeller efficiency, and H.M.S. "Garry" may be looked upon as an early example of this type of stern for destroyers. The resistance of the hull is hardly affected as compared with the ordinary round-bottom stern, but the propeller efficiency is increased to a remarkable extent, a knot more speed being obtained for the same expenditure of power.

Having fixed on the weight of the hull and machinery, the designer is then in a position to say how much weight can be allowed for the armament and fuel on a vessel of certain displacement. The importance of weight on a modern destroyer may be illustrated by stating the fact that for every pound weight thrown overboard the vessel will be ½ in. further ahead each hour, or for every ton weight saved half a length of the ship will be gained in an hour's race.

The relationship which exists between the various parts is one of the most important factors in the success of a destroyer, not only from the point of view of speed, but also from the point of view of seaworthiness. Any Government Department is in an unfavourable position in this respect as compared with a private firm, because in the latter there is one head who is in a position to settle what he considers to be the best compromise. Sometimes the hull has to be cut down, and sometimes the machinery, and sometimes it is necessary to say that the armament is not suitable for that particular size of vessel. In firms who make their own designs, it has been noticed that every now and again a design is arrived at which gives results far ahead of what has been before obtained. For instance, in 1894, Sir Alfred Yarrow constructed the "Sokol" for the Russian Government, which was a vessel 190 ft. long by 18 ft. 6 in. beam, with twin-screw engines of a total indicated horse-power of about 4,000 and Yarrow water-tube boilers. Her armament comprised one 75 mm. gun, three 47-mm. guns, and two deck torpedo tubes. She was the first vessel to attain a speed on trial of 30 knots, and this result was obtained principally by the adoption of water-tube boilers, and high-tensile steel in the construction of the hull. This special steel had a tensile strength of from 37 tons to 44 tons per square inch, and an extension of not less than 15 per cent. in 8 in. for plates 3-16 in. thick. Its application permitted a reduction in thickness of 12 per cent. below that of the mild steel previously used, with such a saving in weight of hull that an extra knot was added to the speed. All the stanchions were made hollow, pressed steel was used wherever possible instead of cast metal, and for cabin fittings aluminium was adopted, all in order to save weight. She was built at the same time as other destroyers which had a difficulty in obtaining 26 knots.

The "Sokol" was gradually improved upon in future designs. Keeping as near as possible to the same relationship of weights and form, and taking advantage of every modern improvement, what was considered one of the very best vessels they ever built, namely, the Mode, was constructed in 1902 for the Swedish Government. She was 220 ft. 3 in. long by 20 ft. 6 in. beam, and had four Yarrow boilers, and twin-screw reciprocating engines of a total indicated horse-power of 6,400. The speed realized on the official trial was nearly 32.5 knots. For the size and power this was a remarkable result, especially as it was obtained when burning coal under the boilers.

The adoption of oil fuel was perhaps the next great step forward in the evolution of destroyers, and an enormous amount of credit is due to the Admiralty Experimental Station at Portsmouth, which brought oil-fuel burning apparatus to the perfection which is now known. One cannot help feeling that there must be some engineer officers whose names ought to be made public so that due honor might be paid them for their work in connection with one of the greatest improvements for war vessels, especially as it placed this country far ahead of the rest of the world for many years.

In 1910 the Admiralty, at Admiral Jellicoe's initiative, gaves Messrs. Yarrow almost a free hand to do the best they could with a certain sum of money. The result was an outstanding design from which the Firedrake, Lurcher, and Oak, were built. Their dimensions were 255 ft. long by 25 ft. 7 in. beam, and each was fitted with Parsons' impulse reaction turbines and three oil-burning Yarrow boilers. One of these vessels on the offi-

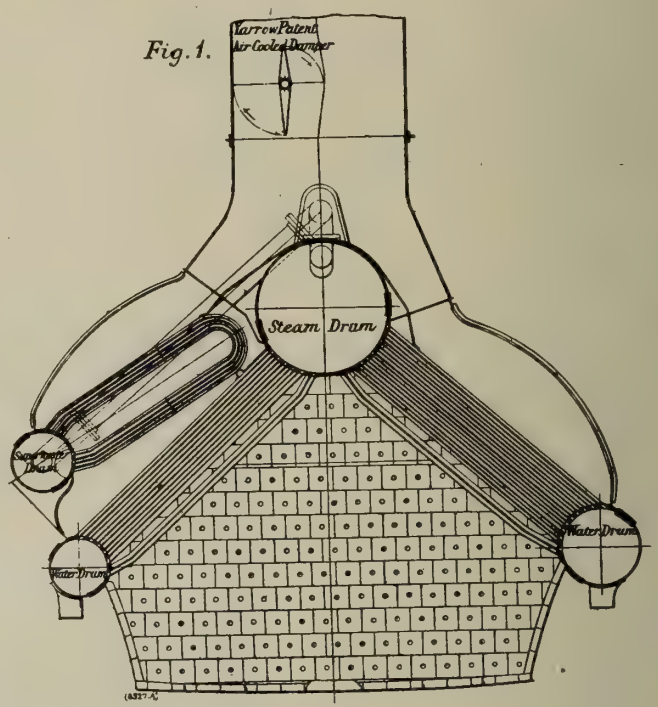


FIG. 1.

cial trial of 8 hours duration obtained a speed of 35.354 knots.

The next important advance was in the direction of superheating. It had been long known that superheating offered great advantages both as regards economy and reliability, but in spite of many attempts it was not looked upon with great confidence for marine purposes. It was, however, so attractive that a special marine superheater was designed and fitted on one side only of the Yarrow boiler, by which arrangement the superheater is placed under control, and that without seriously interfering with the total output of the boiler (see Figs. 1 and 2). If too much superheat is being obtained it is possible to send a larger proportion of the gases up the side of the boiler where there is no superheater, and although there might be a trifling loss in efficiency, yet the total output of the boiler is not substantially reduced. If the superheat is not sufficient, then more of the furnace gases can be sent up the side of the boiler on which the superheater is placed. This control of the amount of superheat was found very valuable, especially in the experimental stage.

It may here be mentioned that with a properly-designed Yarrow boiler having the superheater on one side that higher efficiencies of the boiler plant have been obtained than with a boiler without a superheater, that is to say, more heat units have been transferred from the oil fuel to the steam produced. This result is rather remarkable, and points to the high efficiency of heat transference in a well-designed superheater.

Owing to the adoption of superheating, in 1913 and 1914 we were again able to produce a destroyer which had a very high overall efficiency. Although superheating had been tried in previous vessels yet the most successful results were obtained in vessels of the Miranda Class in 1913 and in 1914, and it was on this type which Messrs. Yarrow concentrated during the war period.

These vessels showed plainly the advantage of superheating for war vessels apart from efficiency, namely, the ability to rapidly increase speed. It is necessary to exercise great care when increasing speed rapidly on account of the water which flows with the steam, and on account of the condensation which takes place in the engines and turbines while they are being heated up to the full-speed temperature. This presence of water is completely avoided if the steam is superheated, because the superheater itself is a large reservoir of heat, so that although the rate of evaporation in the boilers is very rapidly increased, yet the steam arrives at the engines perfectly dry, and in most cases superheated, thus having some surplus heat available in order to raise the temperature of the turbine itself. A further advantage of superheating is that the engine-room is much cooler and consequently more comfortable. It is always noticed during a race in which destroyers take part that those fitted with superheaters get away much quicker than those using saturated steam, and a start of a mile or two is a very valuable asset in a fight. Vessels of the "Miranda" type are about 270 ft. overall, beam 25 ft. 7 in., and depth amidships 16 ft. 3 in. They have three Yarrow superheating boilers, and are fitted with two turbines of the Brown-Curtis type driving directly the propeller shafts without the intervention of gearing. Brown-Curtis turbines were applied to these vessels on account of the large clearances in this type of turbine which made the use of superheated steam quite safe. Sir Thomas Bell, Engineer-Commander Wood, and Mr. Pigott deserve great credit for the investigations they carried out at Clydebank to make these Brown-Curtis turbines a success, not only on destroyers, but also on much larger vessels.

Fig. 2.

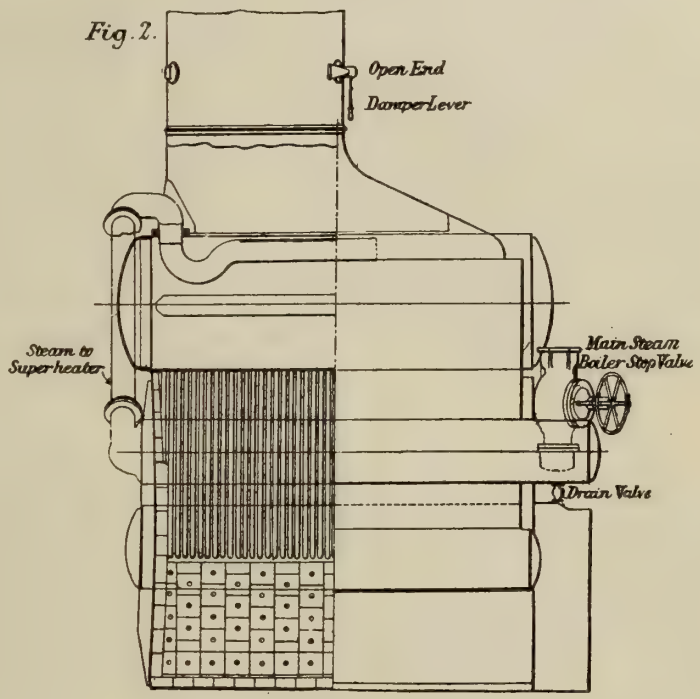


FIG. 2.

In the first vessels of this class a speed of 35 knots and a radius of action of 2,500 knots at 15 knots was guaranteed. In the last vessel of the class, the Tyrian, a speed of 39.7 knots and a radius of action of 3,267 knots at 15 knots was achieved. This speed was obtained on the Skelmorlie measured mile in deep water, which is recognized as being the standard mile for high-speed vessels, it being well-known that in water of a less depth the hull resistance is reduced at high speed and fictitious results may be obtained.

We ought to be very grateful to Messrs. Denny of Dumbarton for providing us with the Skelmorlie mile, which is acknowledged to be the best mile in the world.

High-speed vessels owe a great debt to them for providing the means of obtaining the accurate data on which future progress is based.

When speaking of the measured mile it may not be out of place to propose that a new deep-water measured mile be set up off the north end of Arran, close to the Cock of Arran, and running approximately north-east and south-west. On this course there is plenty of room at the end for the largest vessel to turn round safely and to attain the full speed before entering on the measured distance, while the depth of the water is not less than 40 fathoms.

It is sometimes overlooked how much power is absorbed in accelerating a vessel after the speed has been reduced by a turn at the end of the measured mile.

From careful surveys that have been made off the Cock of Arran, it may be possible to obtain a base two sea miles long, which would lead to more accurate results at high speeds. The measured distance would be in a sheltered position, clear of the traffic, and it would have the great advantage of the course being parallel to the shore. Anyone who has run high-speed vessels will know the difficulty which the pilot has in quickly getting his bearings, for when traveling at 40 knots there is not much spare time to get the correct direction after the turn at the end of the mile, and the direction of the line of the shore is a better guide than swinging compasses. The only reason for proposing a new mile is because the large vessels and high speeds of to-day make it undesirable to run so near the growing excursion traffic and so close to the foreshore of a residential neighborhood.

One of the most satisfactory features of war experience is that vessels of the "Miranda" class suffered little or no damage due to sea conditions. They proved quite strong enough for the various kinds of work that they were called upon to

perform, sometimes under the most trying circumstances.

The Mounsey, under command of Lieutenant Craven, was the means of saving 696 people from H.M.S. Otranto. The sea was very rough at the time, and the Mounsey could not lie alongside the Otranto. She had to steam slowly past while the crew of the latter jumped to her deck, which manoeuvre she repeated several times. The bumping to which the destroyer was exposed during this operation can be easily imagined, but the structure was uninjured.

Another case of interest as showing the strength of these vessels was when the Musketeer went to rescue the crew of the King Edward. The King Edward had overhanging sponsons, and while taking the crew off in a heavy sea, the destroyer got underneath the sponsons which were descending at every roll of the ship on the deck of the destroyer and severely punishing her. Incidentally it may be mentioned that there were some high-explosive shells in the ready racks on the deck of the destroyer which caused the captain a good deal of anxiety each time the sponson struck the deck, but fortunately none of them went off. In this case several plates were actually torn away, but the main structure was uninjured, and she was quickly repaired and again ready for active service.

It is not generally realized how severe are the tests to which high-speed vessels are subjected by the gun armament. When one considers the recoil of a 4.7 in. gun on such a light structure, or the recoil of a 4-in. gun repeated 20 times a minute, it is remarkable that no ill-effects are experienced. One of the tests on a gun trial is that a man should be able to keep his eye on the sighting telescope while the gun is being fired. If there is the slightest yield in the mounting, apart from the recoil chamber, it will be seen that the telescope is likely to strike the man a nasty blow. The structures are so designed that the gunlayer has no difficulty in keeping his eye fixed on the target even while the gun is being fired.

The success of these light structures is in a measure due to the uniformity of elasticity longitudinally, which is a great source of safety. Some vessels have no doubt come to grief through sudden changes in strength, and it appears that uniformity of elasticity is one of the most important points in this class of light construction.

I think you will agree with me that special credit is due to the designing staff both of ship and engine departments, which can successfully produce a high-speed destroyer, and any firms who have constructed these vessels will know the accurate workmanship which is required and obtained by special overseers appointed by the Admiralty for this type of vessel.

The directions in which further advances in speed may be looked for are as follows: (a) Improvements in the shape of the hull, so as to reduce the hull resistance; (b) improvements in the shape of the hull in wake of the propeller, so as to increase the propeller efficiency; (c) perfect balancing of the propeller, and the removal of the propeller as far as possible from any disturbance which may be caused by the propeller brackets; (d) reduction in the weight of machinery by the adoption of high-speed turbines; (e) reduction in the weight of machinery by increasing the output of steam from the boilers; (f) by the careful elimination of any items which are not necessary for the ordinary upkeep of the ship. To provide for extraordinary occurrences is handicapping the ship by carrying weight which will probably never be used; (g) reduction of the skin friction by eliminating all outside traverse laps, especially at the forward end of the vessel, as first pointed out by Mr. Baker.

During the war Messrs. Yarrow were also called upon to design and construct some high-speed gunboats for river purposes, known originally as the China gunboats. In such vessels the problem of speed is entirely different from that of a destroyer.

It is well known that they were ordered by Lord Fisher for use in Mesopotamia, and he gave Messrs. Yarrow an entirely free hand with respect to their design; the only stipulation being that they were to be ready for service in the shortest possible time, and that they were to be a success. Sixteen small vessels were designed and built at Scotstoun, and 12 larger vessels were designed at Scotstoun and built by Messrs. The Ailsa Shipbuilding Company, Messrs. Barclay, Curle & Co., Messrs. Lobnitz, Messrs. The Sunderland Shipbuilding Company, and Messrs. Wood, Skinner & Co. The problem was to carry a certain armament at the highest possible speed on a shallow draught, and at the same time to provide good accommodation for the crew. In the case of the smaller vessels the draught was not to exceed 2 ft. 6 in., and in the case of the larger vessels the draught was not to exceed 4 ft. 6 in. To achieve this result the vessels had to be constructed with a flat bottom, and in order to provide for propellers large enough to utilize sufficiently the power required for the speed, the vessels were fitted with tunnels, so that when at rest the propeller was only half-immersed, and when running the tunnel filled itself automatically, the propeller then working totally immersed. The after end of the tunnel when starting has necessarily to be below the surface of the water to allow for the expulsion of air and to provide an air lock, but when the tunnel is full and the water is flowing through it at a high velocity, the resistance of the vessel can be greatly reduced if the after end of the tunnel be raised up so as to be almost horizontal. This is accomplished by means of the Yarrow hinged flap. The efficiency of this flap can be best expressed by stating that for the same power 10 per cent. more speed can be obtained.

The particulars of these vessels are as follows:

	Small	Large
Length .. ..120 ft.		230 ft.
Beam .... 20 ft.		36 ft.
Speed .... 10 miles		18 miles

It is submitted that, to obtain 18 m.p.h on a draught of 4 ft. 6 in. when carrying two 6-in. guns is as good a performance as 39.7 knots in a destroyer.

When mentioning high-speed vessels there ought to be included such outstanding examples of naval architecture as the Repulse and Hood, built by Messrs. John Brown & Co., and the Renown, built by Messrs. Fairfield Shipbuilding Company, which have obtained speeds never thought practicable with such gigantic ships. One cannot help feeling proud of the part which the Clyde has played in obtaining these various record results, and as long as there is the same cordial co-operation between employers, the scientific designing staff and the workmen, there need be no anxiety about records in the future.

CONVERSION OF "KIL" CLASS GUNBOATS INTO CARGO STEAMERS

The light vessels now being converted by J. Samuel White & Co., Ltd., East Cowes, I.W., are the Kilmford, Kilmarten, Kilmuckridge, Kildavin, Kilmead, Kilmallock, Kilmore, Kildorry.

The majority of these vessels were built by Smith Dock Co., at Middlesborough, and their dimensions are, generally, as follows:

Length, between perpendiculars, 170 ft.; beam 20 ft. 10 in.; and depth, moulded, 16 ft., 6 in.

The conversion is being carried out in compliance with British Corporation Rules, Class B.S., and the work includes the straightening of the stem (these boats are double-enders) and the building of a forecastle.

All are equipped with two boilers. The forward one has to be removed and the space adapted to a cargo hold.

The existing triple expansion engine will remain in its original, position, and will give a speed of about 10 knots.

The conversion allows for a deadweight capacity, including bunkers, of 650 tons, of which the coal bunker capacity is to be 80 tons.

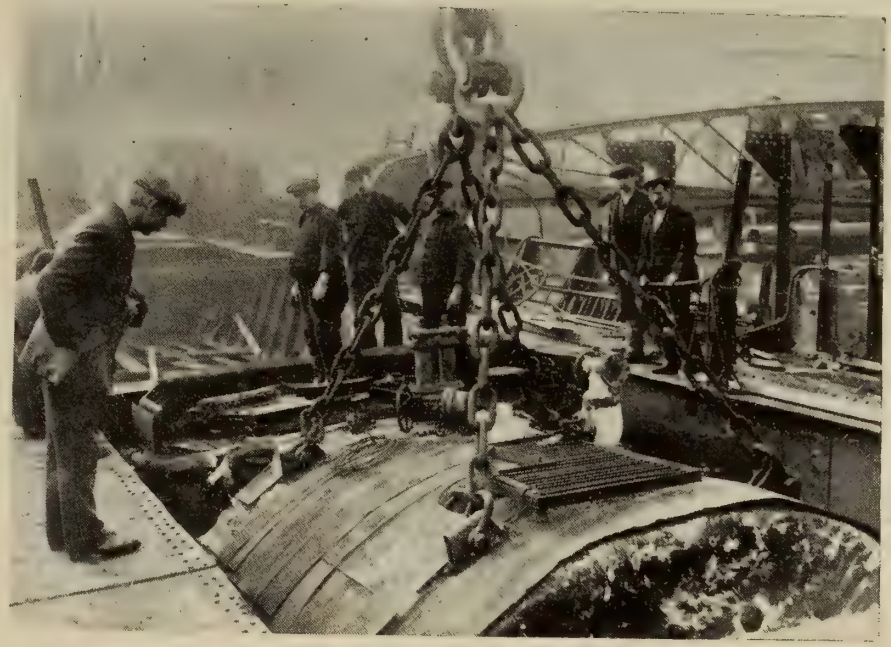
The forward cargo hold is to have a capacity of 23,000 cu. ft., with a cargo hatch 38 ft. by 19 ft., and the after cargo hold 5,900 cu. ft., with a cargo hatch of 22 ft. by 11 ft.

Two steel masts are to be fitted to each boat, and a wood derrick having a 3-ton lift is to be placed at each mast. A cargo winch 6 inches by 10 inches will be fitted at each hatch.

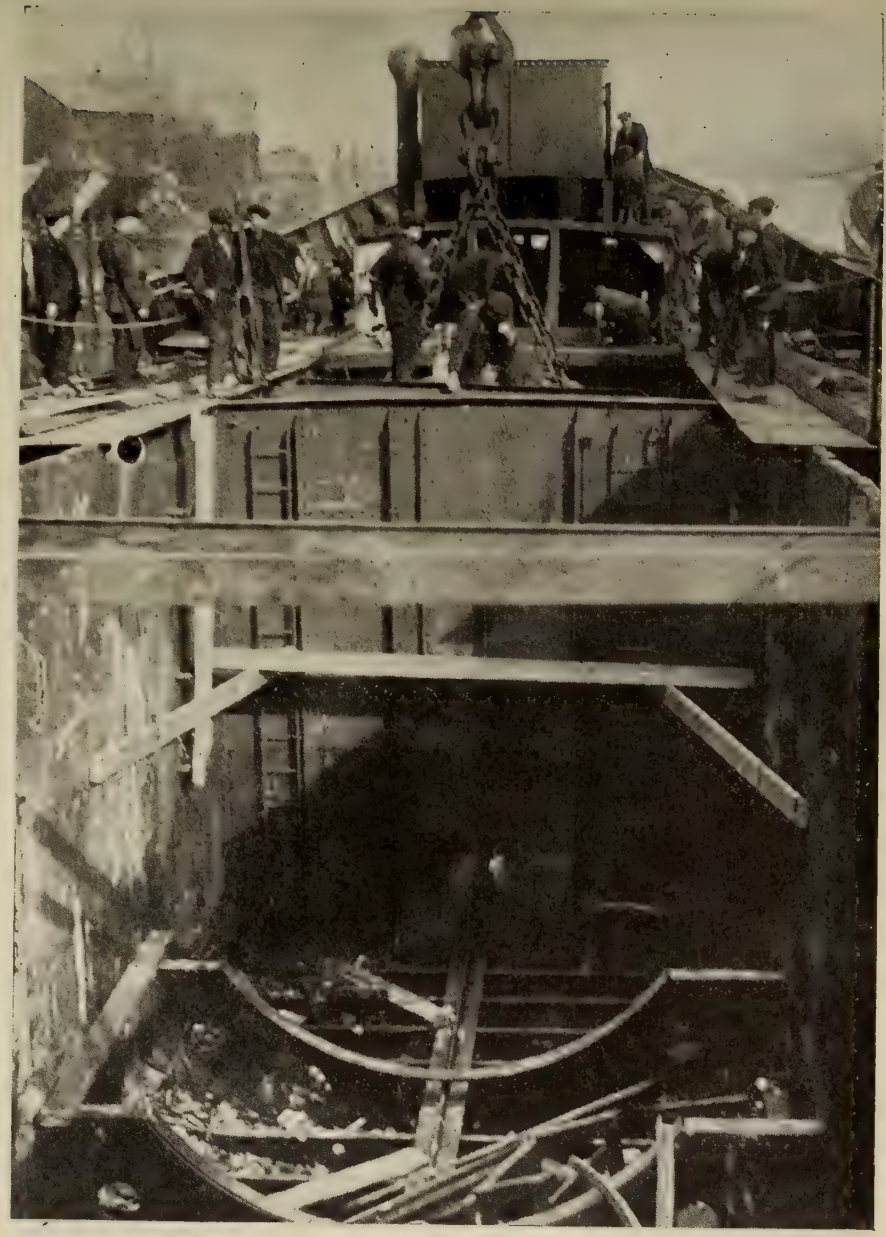
Accommodation has to be provided for 19 officers and men in each ship.

The crew will be berthed under the forecastle, and the side plating amidships will be extended to enclose the bridge space, where accommodation will

THE ONE BOILER LEFT IN EACH SHIP IS BEING THOROUGHLY OVERHAULED AND FIXED IN POSITION.



REMOVING ONE OF THE TWO BOILERS IN EACH SHIP TO PROVIDE FOR SPACE FOR A CARGO BOAT.

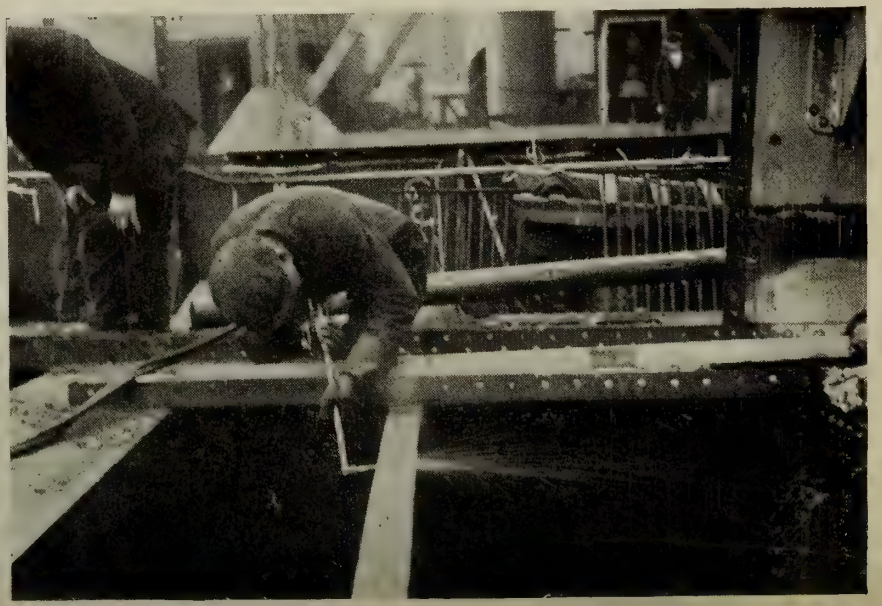


A BOILER HAS BEEN REMOVED FROM THIS HOLD, WHICH, IN FUTURE, WILL BE DEVOTED TO THE CARRYING OF CARGO.

TORPEDO TUBES, MASTS, CHAIN CABLES, AND OTHER GEAR REMOVED FROM ONE OF THE GUNBOATS AS A PRELIMINARY TO CONVERSION.

PUNCHING OUT RIVETS PRIOR TO THE REMOVAL OF STEEL PLATES.

A "KIL" BOAT BEING TOWED FROM SOUTHAMPTON WATER TO COWES FOR CONVERSION. THEY ARE ALL DOUBLE-ENDERS.



CUTTING A STEEL GIRDER ON THE "KILMORE" BY THE OXY-ACETYLENE PROCESS.

be provided for the officers on the main deck, while the chart and wheel house will be on the bridge deck.

From start to finish the work of conversion will average about two months for each ship.

STEAMSHIP "CANADIAN RUNNER"

The Steamship "Canadian Runner" left the plant of the Port Arthur Shipbuilding Company, Limited, on Sunday, August 8th, with a cargo of grain for Port Colborne, this being her maiden trip on her way to the ocean.

This boat was built for the Canadian Government at a cost of one million dollars, and is the largest ocean-going freighter ever built on the Great Lakes. She will be cut in two at the plant of the Great Lakes Engineering Works, Ashtabula, Ohio, and the two sections towed through the canals and locks to Montreal where they will be rejoined at the plant of Canadian Vickers, Limited. The towing will be done by the tugs of the Great Lakes Towing Company.

This vessel is one of two just completed at the plant of the Port Arthur Shipbuilding Company, Limited, Port Arthur. Her dimensions are as follows:

	Feet	Ins
Length over all	333	7
Length B. P.	319	10⅝
Molded breadth	43	10
Molded depth	25	0

with 'Tween decks, and having a deadweight capacity of 4,500 tons. Her power plant is located amidships and consists of triple expansion condensing engine, 1,900 H.P., served with two Scotch marine type boilers 15 ft. dia., by 11 ft. long, forced draft. Propellers are made of bronze. The vessel developed a speed of 12 knots on her trial trip.

This vessel will be operated by the Canadian Government Merchant Marine Limited, between Canada and the West Indies.

LAUNCH AT COLLINGWOOD

On Tuesday, 27th July, The Collingwood Shipbuilding Co., Ltd., launched from their Collingwood yard the bulk oil steamer "Transpet."

This vessel is being constructed to the order of the Standard Oil Company of New Jersey, for special service at Buenos Aires and will be registered in the name of "Compania Transportadora de Petroles, of Buenos Aires."

The vessel was gracefully christened by Miss Susan Smith, daughter of Mr. G. H. Smith, President of the International Petroleum Company, Toronto.

This is the sixth oil tanker which The Collingwood Shipbuilding Company has built for the Imperial Oil, International Petroleum and Standard Oil Companies, the previous five, however, being larger ships.

The "Transpet" is being built under the special survey of Lloyd's Register of Shipping and will take their highest class for river service, and is also designed to meet the requirements of the Argentine Port Authorities.

The leading particulars are as follows:

Length over all, 175 feet, 8 inches; length B.P., 170 feet 0 inches; breadth moulded, 35 feet 0 inches; depth moulded, 10 feet 6 inches; load draught, 8 feet 0 inches; load deadweight, 625 tons.

The cargo is carried in twelve tanks, six on each side of the vessel. At the forward end there is a small hold for general cargo. This is separated from the oil tanks by a cofferdam and is served by a small derrick on each side of vessel. The machinery is located aft with a cofferdam, oil, fuel, tank and pump room between machinery space and aftermost cargo oil tank. An expansion trunk runs continuously from boiler casting front to end of forecastle. The vessel is designed to carry heavy crude oil, steam heating coils being fitted in the tanks to facilitate pumping. The crew is housed in the forecastle and officers and engineers in deckhouses aft at each side of machinery casings. Peak tanks are arranged to carry fresh water, and feed water will be carried in a double bottom tank under engines.

The vessel is fully equipped with steam windlass, steam steering gear, electric lighting and refrigerating machinery and cold chamber.

The propelling machinery consists of a set of triple expansion, surface condensing engines, having cylinders 12¾ inches, 21½ inches, and 35 inches by 24 inch stroke. Steam is supplied by one single-ended Scotch marine boiler 11 ft. 8 inches diameter by 10 ft. 6 inches long and designed for a working pressure of 190 pounds. The boiler is equipped for oil burning. The designed speed is 8 knots loaded.

The arrangements for handling the oil cargo are complete. Two duplex pumps 12x9x18 are provided with piping so arranged that the cargo tanks can be either pumped up or out. The main suction lines are 6 inches with 4 inch branches to each tank.

The C.M.G.S. "CANADIAN RUNNER"

Warns Coal Operators.—Speaking in Washington recently to the coal operators of the National Coal Association, Mr. J. D. A. Morrow, vice-president of the association, gave the members a solemn warning. Unless the coal operators of the country could meet the demands of the people for fuel, he told them, the industry was faced with a resumption of Government control, which would be very difficult to get rid of. The Northwest was short of 5,000,000 tons and a plan giving priority to coal for the Northwest had been agreed upon with the Inter-State Commerce Commission. It was up to the coal operator to make this arrangement a success and fill the deficiency.

Charles C. Phelps recently became associated with the Uehling Instrument Co., 71 Broadway, New York, combustion engineers and manufacturers of CO_2 recording equipment and other fuel economy apparatus. He is devoting most of his attention to research work in connection with the efficient combustion of fuel oil in boiler furnaces. It is estimated that nearly $100,000,000 is wasted unnecessarily every year, due to improper methods of burning fuel oil, which fact shows the importance of this field of investigation. Mr. Phelps graduated from Stevens' Institute of Technology with the degree of mechanical engineer and has since spent several years studying power plant problems. For five years of this period he was connected with the Ingersoll-Rand Co., manufacturers of power plant equipment and pneumatic machinery. Mr. Phelps is an associate member of the American Society of Mechanical Engineers.

Vancouver.—The contract for the $3,000,000 dry dock to be built on Burrard Inlet by Coughlan & Sons, has now been signed, and it is understood that work will be started in sixty days from the date of signing.

Common Sense in Engineering

A Lecture Delivered During the J. E. Aldred Lectures on Engineering Practice at John Hopkins University.

By WALTER M. McFARLAND

THE term "common sense" is used with great frequency, and yet, as you know, with different meanings. Indeed, it is sometimes said that common sense is really very uncommon. To avoid ambiguity, we will attempt a definition as follows: "Common sense" is the application to the solution of problems of one's best experience and judgment without prepossession or prejudice. The qualifying clause is most important, because innumerable cases have occurred where an erroneous decision was reached by men of great ability just because they allowed their judgment and experience to be overruled and biased by prepossession or prejudice.

Possibly the most striking case of this kind, which is known to everybody, is that of the unwillingness of the Syrian general Naaman to take the advice of the prophet Elisha in order that his leprosy might be cured. You remember that the prophet told him to wash in the River Jordan. Naaman's prejudices, however, made him object to this extremely simple cure, and he wanted to know why the rivers of Damascus would not be better. His servant had more common sense than the master, for, as you remember, he said to him that if the prophet had directed him to do some great thing he would have done it at once, and why not follow out this perfectly simple injunction? The common sense of the servant prevailed and the general was cured of his leprosy.

It should also be very thoroughly understood that so far from excluding all the benefits of education and intellectual training, the true meaning of "common sense" assumes these as vital factors. In other words, to praise and emphasize the importance of common sense does not mean to disparage education, but, on the contrary, insists upon it most strongly. On account of the native shrewdness sometimes exhibited by uneducated men there is occasionally a tendency to think that common sense is a gift which can compensate for the lack of education. In fact, the shrewdness displayed by the uneducated men when analyzed will be found to agree entirely with our definition above. They are really keen observers, and have, within their limit, good experience, so that the sound judgment which they display is really a good illustration of common sense. It would be found, however, on test that the field within which their judgment could be exercised is very limited as compared with that of the highly-educated engineer.

In discussing the subject of our lecture I propose to follow what is called in the law schools the "case system"; that is, to develop principles by the examination of specific cases. This is usually clearer, more interesting and more satisfactory than to announce abstract principles and then attempt to elucidate them.

A striking illustration of common sense in engineering is the revolution in the use of steam brought about by James Watt, inventor of the separate condenser. The steam engine as invented and developed by Newcomen was doing useful work, but it was very generally realized that it was exceedingly wasteful. As you will remember, the engine worked at atmospheric pressure, steam being admitted from the boiler underneath the piston, which was slightly overbalanced so that it would then ascend to the top of the stroke. A spray of cold water was injected inside the cylinder, which condensed the steam, producing a partial vacuum. The pressure of the atmosphere caused the descending stroke of the piston. It seems to us now that it ought to have been perfectly evident that, as the cylinder was necessarily chilled in causing the condensation of the steam, there would inevitably be great initial condensation of the newly-admitted steam before the temperature could be raised sufficiently to permit the steam to fill the cylinder, and that, in consequence, it was almost obvious that the condensation should take place in a separate vessel. It was, however, not until the Newcomen engine had been used for nearly seventy years that this revolutionary change was made by Watt, who was led to it when making repairs to the model of a Newcomen engine at the University of Glasgow. It must not be supposed because Watt was an instrument maker that he was not a scientific man. He was a friend and pupil of Professor Black of the University, who is, perhaps, best known as the discoverer of latent heat, and it is probable that this scientific knowledge led him to the careful study of conditions which resulted in the invention of the separate condenser.

As you know, Watt made other great inventions connected with the steam engine, so that, speaking generally, up to the time of the invention of the steam turbine the improvements made by later inventors were almost entirely in matters of detail rather than of principle. It is very interesting to note in this connection that, in spite of his shrewd common sense in his earlier inventions, Watt's prejudices led him to oppose very strongly the use of high pressures. Doubtless it was because the success of his early work in connection with very low pressures that he was so prejudiced, but it illustrates the point that, notwithstanding his wonderful ability, he did not use common sense with respect to the higher pressures.

As we now look back over the further improvements in the steam engine, we are greatly surprised to find that it took so long to apply fully the principles which Watt had announced of endeavoring to keep the cylinder as hot as the entering steam. Of course, it is impossible to do this completely when the cylinder head and passages have just been in communication with the exhaust at a much lower temperature than the incoming steam. Nevertheless, it should have occurred to a careful analyst of the conditions that division of the expansion into two or more stages in separate cylinders would make the temperature variation in each particular cylinder very much less and would thereby conduce to economy. Long after the compound engine, with the expansion in two stages, had become quite common this point was not fully appreciated. Indeed, as late as 1880 Rankine's Treatise on the Steam Engine, then considered the best work on the subject, distinctly stated that, so far as economy in the use of steam is concerned, it made no difference whether the expansion occurred in one, two or a dozen cylinders. After the principle was thoroughly appreciated and when improved materials permitted the construction of boilers for much higher pressure, the introduction of the triple expansion and quadruple expansion engines came almost as a matter of course.

For a number of years I had the pleasure of frequent association with that great mechanical genius, George Westinghouse, the inventor of the air brake, while I was an officer of one of his companies, and on one occasion I heard him tell the story of the final step in his invention of the air brake, which is a splendid illustration of common sense. He was led to invent a power brake of some kind by his knowledge of the inadequacy of the means then employed, and his first idea was of one operated by steam. He fully realized the disadvantages due to condensation, but thought at first that these must be accepted. He had devised the brake cylinder and rigging under the car and was nearly ready to experiment. He was a reader of the "Scientific American," and one day the new issue contained a description of the mechanical features of driving the Mont Cenis tunnel under the Alps. This described the rock drills driven by compressed air, and incidentally stated that, at the time the article was written, the heading of the tunnel where the drills were working was about a mile from the air compressors outside the mouth, and that there had been no trouble on account of this distance between the generation and application of the compressed air. He at once realized that here was the ideal fluid for transmitting his power.

If it was satisfactory for the rapid-working pistons of rock drills at a distance of a mile from the compressor, it certainly would be satisfactory in the brake cylinders under the cars at a distance measured by hundreds of feet. Thus was born the air brake, which, with its subsequent developments and improvements, has probably done more for the safety of high-speed railroading than any other single invention ever made.

The first great improvement was again a beautiful illustration of common sense. In the beginning the idea was to apply the brakes on all cars practically at the same moment so as to stop all the cars at the same time. After this had been successfully accomplished and people began to rely thoroughly on the brake, an accident occurred when some cars broke from a train on an incline, which left nothing but the hand brakes to stop the descent of the detached cars. Up to that time, when it was desired to apply the brakes, pressure was admitted to the train pipe, and so to all brake cylinders. Common sense suggested to Mr. Westinghouse that if it could be arranged to keep pressure on the train pipe as the normal condition, with the release of his pressure to set the brakes, then if any cars became detached the brakes on the cars would be automatically set. To carry out this idea he invented what is known as the "triple valve," which, in connection with a reservoir of compressed air under each car, fully accomplished this purpose of complete safety. The triple valve fulfils the three purposes of filling the reservoir under the cars, admitting the air from the reservoir under each car to the corresponding brake cylinder for the application of the brake, and exhausting the air from the brake cylinder when the brakes are to be released.

Nearly all of Mr. Westinghouse's many inventions were illustrations of his splendid common sense, and they were evolved from existing methods to meet conditions which arose in the application of the mechanism. One of these inventions was made while I was with him, and I knew many of the details, so that the story will, I believe, interest you.

When Sir Charles Parsons had invented and developed the steam turbine until it became reasonably economical, Mr. Westinghouse secured the patent rights for the United States and proceeded to develop it chiefly in connection with electric applications. As the power and size of the turbines increased it was found that there were difficulties due to the expansion of the material accompanying temperature changes in such long structures. As you are aware, the Parsons turbine is of the "reaction type." De Laval, a Swedish inventor, had developed a different kind of turbine, known as the "impulse type." In this latter the steam is expanded in special nozzles before entering the blades so as to reach them with a very high velocity and greatly reduced pressure. Familiar as you are with the properties of steam, you know that this reduction in pressure is accompanied also by a reduction in temperature. Mr. Westinghouse was familiar with both types of turbines, and it struck him that the way to obviate the difficulty due to this expansion of the material was a form of compounding turbines somewhat analogous to what has been done in the steam engine. Consequently he bolted to the casing of the reaction turbine a small independent but connected casing containing a few rows of impulse blades and reduced the pressure from the initial figure of about 200 pounds to about 75 pounds when it entered the reaction blading. This smaller casing was free to expand without affecting the larger ones. Along with this he introduced what he called the "double flow" principle by practically puting two reaction turbines in the same casing with the higher pressures in the center and the exhaust connection at the ends. This solved the difficulty, and this method in various forms is the one now used in all the large turbines of to-day.

The Diesel engine is a most interesting subject for consideration by engineers on account of its remarkable thermal efficiency of some 30 per cent., which is about double that of good reciprocating steam engines. In fact, marine records of good average practice are one-half pound of oil per brake horse-power for the Diesel engine and about one pound of oil per indicated horse-power for a good reciprocating engine plant.

More than twenty years ago Dr. Diesel believed he had perfected his engine, and many engineers who had studied his work went so far as to say that the steam engine would be obsolete in a few years and would only be found in museums. For a considerable interval thereafter little more was heard of it until about ten years ago. Possibly it was because the basic patent expired at that time and possibly because the engine had been worked out commercially; but at all events the technical papers were full of accounts of Diesel engines being fitted to numerous vessels, and again there was the same prediction that the steam engine would soon be displaced. As a matter of fact, the extent of the use of the Diesel engine has been a great disappointment to its advocates, and at the present time relatively few are now being installed in new vessels.

As information was published of the details of these engines, it became apparent that they were all designed with a horse-power per cylinder which did not exceed 250 to 300. At first there were a great many vague statements that experiments were in progress with cylinders to give from 1,000 to 4,000 horse-power per cylinder. In one such experiment there was an explosion with serious consequences. At all events, for some time there has been no talk of these more powerful cylinders. It will be realized at once that if any prime mover is to be used for large powers it must be capable of construction in large units. The reciprocating engines of the SS. "Olympic" have cylinders of 4,000 horse-power each, so that a single four-cylinder engine develops 16,000 horse-power. A Diesel engine developing only 250 horse-power per cylinder would, of course, require sixty-four cylinders to give the same power. The enormous multiplicity of parts to be looked after and kept in adjustment, even if this were individually easy, would be sufficient to prevent such use, while, in fact, the Diesel engine requires unusual care and attention to keep it in good order.

The question naturally arises, "Why is it that the Diesel engine cannot be built in large sizes?" And here common sense gives us the answer quite simply. Like all other internal combustion engines, the Diesel engine requires that the cylinders be water-jacketed so as to keep the barrel sufficiently cool to permit the proper working of the pistons. The pressures carried are quite high, from 700 to 1,000 pounds per square inch, requiring a thick cylinder even for a power of 250 to 300 horse-power. The fact is that this thickness is evidently about the maximum which will permit the interior cylinder wall to be kept of a sufficiently low temperature for satisfactory working. It happens that cast iron is by far the best material which has ever been found for the cylinders of quick-moving reciprocating engines. If a material could be found which has all the fine wearing qualities of cast iron with several times its thermal conductivity, then we might expect Diesel engine cylinders of greater power; but until that comes, or there is some other radical invention, the nature of which is not now apparent, the Diesel engine seems limited to small powers.

There is another aspect of this case where that form of engineering common sense which we may call the "commercial side of engineering," comes in very prominently. Popular descriptions of Diesel engines have always laid stress on their elimination of the boilers, with a consequent saving in space. They have, so far as I know, carefully avoided a comparison of weights. Through the kindness of a friend who is a Chief Engineer of a large shipbuilding company, and who had made a very careful comparative study of Diesel engines and steam turbines for certain vessels, I have been enabled to secure reliable data on this point of weight. You will perhaps be surprised to learn that for about 3,000 shaft horse-power the Diesel engine installation weighs nearly double the steam plant, including turbines, boilers and auxiliaries. As might be expected, there is also a very great difference in the first cost, the Diesel engine exceeding the steam plant by over 50 per cent. My friend made up a very careful comparison of the operation of the two vessels, identical except machinery, extending over a year, with the net result that the earnings based on first cost worked out to almost exactly the same percentage.

This discussion emphasizes the impor-

tance of remembering that thermal economy in an engine is only one of the factors to be considered in determining on the adoption of oil or steam engines. The matter may be put this way: every commercial enginering product must show a profit on the investment. This is just as important as high efficiency, adequate strength or admirable design. Failure to show a profit will offset the greatest merit in these other features.

A striking illustration of common sense in engineering came under my personal observation when I was in the naval service, and is worth careful study.

The early vessels of what was then called our "new navy," designed from, say, 1885 to 1890, were fitted with independent air pumps for the main engines. There were usually two air pumps driven by a small two-cylinder compound engine of the crank and flywheel type, the connecting rods of the pumps attaching to the same crank pins as the connecting rods of the engine. While an excellent design from the standpoint of a steam engine for ordinary purposes, there was a serious defect in thees engines which was not realized until after they were put in use, due to assuming that an engine which would be satisfactory for ordinary purposes would be equally satisfactory for operating an air pump. In practice they proved very unsatisfactory. If they were given sufficient steam to handle a heavy load then they would run away with a light one. If they were adjusted for the light load then they would stop when a heavier load came on them. In practice this required a man to give them almost constant attention, which was very undesirable.

As soon as this trouble was recognized, the designers at the Navy Department and in various shipyards began to scheme methods of remedying the difficulty, and various methods were tried without success. Meanwhile, the makers of standard twin-cylinder air-pump work somewhat on the lines of their direct-driven water pumps, and this type of air-pump had proven a great success. It could be run at any desired speed, depending on the output of the main engine, and required practically no attention. After this pump became available it was used exclusively, but the older ships remained with the unsatisfactory air-pumps, and it was highly desirable, if possible, to correct the defect without replacing the air-pump engines. Finally Chief Engineer Bailey (now Admiral Bailey), then Chief Designer in the Bureau of Steam Engineering, took up the problem. I knew him intimately, and he gave me the details of his solution of the difficulty.

Recognizing that the direct-driven air-pump was unsatisfactory, his first step was to find the points of difference between this type and the air-pump engines previously used. The compound engine had been designed with steam ports of the usual proportion, namely, 10 per cent. of the piston area. In the direct-driven type the ports were only about 3 per cent of the piston area. In the direct-driven type the port opened wide at the very beginning of the stroke and stayed wide open until almost the very end. The valve gear of the compound engine was arranged, as is usual in such engines, to cut off at about three-quarters stroke; and, being driven by an eccentric, opened gradually and closed gradually, being wide open for only a short time. Mr. Bailey's conclusion was that the direct-driven pump builders had wisely decided to make the port so small that, if the load on the pump became very light and there was any tendency to run away, the steam would be wire-drawn by the small port enough to prevent any excessive speed. On the other hand, if a very heavy load came on the pump, the port being wide open would permit the steam pressure to come in to its full extent so that the piston could not stop. With the existing conditions of the older plant he must continue to drive the valve by an eccentric, but he knew a valve seat could be fitted with ports about 4 per cent. of the piston area, and a new eccentric and valve could be fitted to work without lap or lead so that the port would open at the beginning of the stroke and would be open to some extent at all times. This change was made, and the result was complete satisfaction, as I can testify by personal observation from having been on a vessel where the change was made during my service. I consider this one of the best illustrations of common sense in engineering that I know. The change was not serious, was comparatively inexpensive, and it accomplished thoroughly the aim of the designer.

It was emphasized in the beginning of the lecture that common sense does not mean lack of education or absence of fine professional equipment. Indeed, these are vitally necessary, and the story which I am about to tell you will show that a well-equipped man is able sometimes to give an opinion which to the uninformed seems almost uncanny.

An accomplished naval engineer, who was one of my instructors at the Naval Academy, once told us of an amusing experience with reference to estimating the speed of a ship. He was attached to a vessel on the Asiatic Station, and during his service a new passenger vessel came out from England which was reputed to be very fast for those days. The two vessels happened to be in port together, and when passing the liner one of the officers remarked that the vessel could make sixteen knots. My friend looked at the vessel a little while and said: "That is impossible, and her speed is probably not over fourteen knots." He was at once asked how he could be so sure, and he replied: "I can tell by the size of the smokepipe." This led to jeers from some of the party, who really thought the answer was a joke. Those of you who have studied boiler design at all will probably know at once that there was a real foundation for his statement, and for the benefit of the rest I will give this analysis of the way in which he formed an opinion.

In a well-designed boiler installation there is a definite relation between the cross sectional area of the smokepipe and the grate surface. It was before the days of forced draft, so that he knew the amount of coal that could be burned per square foot of grate surface, and, with the average economy of the machinery, the horse-power which would result. He was a man who had made a careful study of the propulsion of vessels, and knew roughly about what horse-power would be needed to drive a vessel of the size in question at a speed of sixteen knots. He could estimate fairly the diameter of the smokepipe, and with this as a basis, a hasty mental calculation showed that the power which the machinery could develop was very much less than would have been necessary for sixteen knots. If any of you have had the opportunity to observe the trans-Atlantic steamers you will appreciate this point about the smokepipe by the actual conditions of some of the great liners of today. The SS. "Mauretania," which is a vessel of about 70,000 horse-power and twenty-five knots speed, has four huge funnels, while the White Star liners of nearly the same displacement have only two moderate-sized funnels, but they make only about 16 knots. So you see that a man who is well posted professionally in marine matters could really form a fair judgment as to speed of a vessel by the size of her smokepipe.

A very important feature in your engineering education and experience is to discover in any specific case the general principle which is involved and which may often be utilized to advantage elsewhere with considerable differences of detail from the original case. A circumstance of this kind came under my observation which illustrates the point quite well.

It was customary in the engines of the Navy up to about the beginning of the so-called "new navy" to make the eccentric straps of brass. Somewhat earlier than this, when steel castings had become available, designers for engines of the merchant service had made eccentric straps of steel castings lined with white metal, the idea being, of course, that the white metal furnished the suitable bearing surface, while the steel casting gave adequate strength. The steam launch on one of our vessels had the eccentric straps made of brass, as usual, half an inch square in cross section, and one of them broke. It was the lower half, which was a half circle with lugs to bolt to the other part. The young engineer who was charged with the repairs did not know of this practice in the merchant service, and having always seen eccentric straps made of brass, tried to make a temporary repair by taking a couple of sheets of one-quarter inch sheet brass, bending them to shape, riveting them together with a few copper rivets and bending over the ends to make lugs for attachment to the other part of the strap. Un-

fortunately, sheet brass is rather brittle, and, as might have been expected, this temporary strap broke off where the lug had been bent. After trying this a couple of times he was about to give up the attempt at repair and have a new strap made at a shop on shore. Another young engineer on board knew of the practice in the merchant service. It was out of question, of course, to get a steel casting, and it would have been difficult to arange for using white metal, but he remembered the principle of a proper bearing metal to go against the eccentric, backed up by a stronger one to stand the stress. Accordingly he took a piece of half-inch square bar iron, had it bent to shape and faced it with one of the strips of one-quarter-inch sheet brass, securing it to the wrought-iron backing with the copper rivets. This was properly fitted to secure a good bearing, and, of course, worked with entire satisfaction. Later on a new brass strap was secured for use, if necessary, but the repair was so satisfactory that the new strap was never used.

From the circumstances existing in educational establishments it is practically a mater of necessity that in solving problems the data should be furnished you and your work should be chiefly the handling of these data. When you get out into actual practice an exceedingly important part of your work will be the securing of these data accurately, which means that the observations must be made with care and with the aim to be thoroughly correct and reliable. It is not always possible to devise simple checks on the observations which will tell at once whether the records are reasonably accurate, but there are many cases where such checks do exist, and you should endeavor, if possible, to ascertain what such checks are. Some will come from previous observations and experience, some from study, but a great many will be a matter of common sense. A striking case which came under my observation and where common sense was the check is worth telling.

Most of the Mediterranean ports are protected by breakwaters so that the water inside is smooth, and as a result when coal is brought off to vessels it is in rectangular piles on flat scows. Unfortunately, coal dealers in the Mediterranean have a rather bad reputation for trickery. Consequently, in naval vessels when coal is taken on board great care is used in measuring the coal piles so as to be sure of the amount received. I was attached to a vessel which called in the harbor of Algiers. A couple of our midshipmen were detailed to measure the coal piles which were, roughly, 40 feet long, 20 feet wide, and between 5 and 6 feet high. At the end of the first day they handed in figures to show the amount received. which came to 375 tons. The executive officer of the vessel had been attached to her for some two years, and so was familiar with the rate at which coal could be taken in. He said at once that some serious mistake had been made for the reason that never before had more than 300 tons been received in one day, even when the conditions were better for rapidity than existed at Algiers.

The midshipmen were told to go over their work again to see if there was any mistake, and they examined their computations but could find no error. I was the possessor of a slide rule, and was, therefore, supposed to be something of expert on figures, and was called in to see if I could find what was wrong. I had had nothing to do with the coaling, b was on board during the day, and happened on several occasions to notice the young men while they were making their measurements. I checked up some of their arithmetical work and found it was correct, so it seemed that the trouble must be in the measurements themselves. I remembered that when I saw them making the measurements the particular piles on which they were working did not come above their heads, while I noticed a great many heights recorded as being over six feet. The solution of the difficulty then occurred to me at once. They had used one of the tape measures from the engine room. If you do not know it now you will learn by experience that the ordinary linen tape measures are fitted with a brass ring in the end for convenience and to prevent the tape from slipping into the case. These rings are invariably torn off after a relatively short service, and the common practice is then to tie a knot in the end of the tape and to make all measurements from the 1 foot mark. I asked the midshipmen if they had used the linen tape, and found they had. It appeared on further investigation that the man who held the knot recorded the figures, which were called off by the man at the other end. The recorder assumed that the other man had deducted one foot before calling off the measurement, while the man at the other end called off what he saw, assuming that the recorder would deduct one foot. There would have been no easy way to check this on the measurements of 20 feet and 40 feet, but obviously it was absurd to put down heights of 6 feet 3 inches and 6 feet 6 inches when, as a matter of fact, they were looking over the piles. Remembering that when I saw them the piles were below the tops of their heads, I asked them if there were any piles which they could not look over. On reflection they said that there were none. I asked then where they got their heights of over 6 feet, and at once the error developed that every measurement they had made was one foot too great. When the correction was made the amount of coal received was only 275 tons instead of 375.

As you hear the story you may think that these young men were unusually stupid. As a matter of fact, this is not true at all, and both have since made enviable records in the navy. They simply failed to use common sense in applying the obvious check as to height when they could look over the piles of coal, which should have at once have called their attention to the carelessness with which they were making the measurements.

While speaking of this subject of checks on observations you will in time acquire a great many of these from practice and experience, and it is well to do so as soon as possible. For example, with good average coal of, say, 14,500 B.t.u.'s per pound, if all the heat went into the formation of steam (that is 100 per cent. efficiency) you would have evaporation from and at 212° F. of about 15 pounds. Likewise, with good quality fuel oil of, say, 19,500 B.t.u.'s the corresponding evaporation would be about 20 pounds. These are figures easy to remember, and when you remember in addition that the best average results in good boilers are about 75 per cent. efficiency with coal and from 80 to 82 per cent. efficiency with oil, you will be in a position to discourage fairy tales about remarkable performances in the way of boiler efficiency. It is the custom now in all carefully-conducted boiler tests to tabulate what is known as a "heat balance," showing the way in which the heat in the fuel is distributed. Two elements of loss which are present in every fuel are the heat carried away in the dry chimney gases and the loss due to moisture formed by the burning of hydrogen. The sum of these two losses at moderate rates of combustion is, roughly, about 15 per cent. in the case of coal, and about 14 per cent. with oil fuel. You will see at once that if all the other losses are eliminated the possible efficiencies would be only roughly some 85 per cent. Consequently, if figures are shown you indicating an evaporation of 13 or 14 pounds of water per pound of coal, or 18 or 19 pounds of water per pound of oil, you will know at once that these results are impossible. Either there has been excessive priming of the boiler or there has been an error in the observation of the amounts of fuel and water.

Some years ago a friend of mine who is a very able engineer was discussing the matter of what is known as "surface combustion," where the gassified fuel passes through a porous earthen plate and burns on the surface. He asked if I had gone into the matter carefully, and I told him that while I had read something about it, I did not know very much. He then went on to say that it was a matter of the very greatest importance because the efficiency with this method of combustion was claimed to be five or six times as great as by any other method. I reminded him at once that this was absurd because a good average performance with oil fuel gave 80 per cent. efficiency, and five times this would have been 400 per cent., which was, of course, ridiculous. He then concluded that the ratio of five or six times referred to the efficiency of an open grate or some other similar very inefficient method of burning coal.

While as engineers we always want our work to be accurate, common sense

teaches us that there is a time for everything, and there are often occasions where you want to reach a decision quickly and where approximate data will be just as useful as those which are absolutely accurate. You will find as you go along that there are a number of "thumb rules" or "round figures" which are very convenient to carry in your memory for just such occasions. For example, a square foot of sheet steel one inch thick weighs approximately forty pounds, which gives you a "round figure" easy to remember and easy to divide for sizes which you are likely to need. The error is only about 2 per cent. Again, one foot in length of a tube four inches in diameter gives one square foot of surface, and two feet long of two inches diameter, and four feet long of one inch diameter. Here the error is a little greater, being about 4 per cent.

There is another convenient figure to remember at the present time—when the question often comes up as to whether it will pay to change a coal-burning installation to one using oil. If you will take the relative thermal values of oil and coal and allow for the higher efficiency when using oil than coal, which is, roughly, about 10 per cent. of the efficiency with coal, you will find that the cost for the same thermal value of fuel may be expressed as follows:

When the price of oil in cents per gallon is half the price of coal in dollars per ton (of 2,240 pounds) the cost for the fuel only is the same. In other words, two-cent oil costs the same as $4 coal. There are economies in using oil due to a smaller boiler-room staff, the absence of ashes and other things, which must be considered, but this "thumb rule" will often enable you to say whether the step is worth considering at all. For example, if oil is selling at five cents a gallon while coal can be obtained for $5 a ton, it is perfectly evident that the difference in the cost of the fuels is so great as to make it unwise to change. If, however, oil, say, is four cents a gallon and coal $7 a ton, the difference is then so small that it is possible the other savings would justify shifting over to oil, so that it is advisable to make a detailed investigation.

From one point of view the talk that I have given you may be regarded as rather disconnected, because so many subjects have been considered, and yet the same theme runs through them all —the application of common sense in the solution of engineering problems. Perhaps the very diversity of the subjects may impress you all the more with the great importance of common sense.

My aim has been to encourage you to develop and trust your own common sense by showing how it applies everywhere and is of the greatest service. Indeed, without it great mental ability is often helpless or goes wrong. One of the most brilliant engineers whom I know, who has designed some of our most important electrical machinery, and who is an accomplished scientist, once said "nine-tenths of good engineering is common sense." And, in closing, let me say again that common sense is not a special gift and does not replace careful study, but it does mean the application to the problem at hand of your best experience and judgment without prepossession or prejudice.

The Uehling Instrument Co., 71 Broadway, New York, manufacturers of fuel economy equipment, announces that it is now being represented in the New England states by the Smith Engineering & Supply Company, 89 State stree Boston, Mass., manufacturers' agent and engineers, specializing in powe plant equipment. Mr. S. W. Smith president of the latter company, wa until very recently associated with th Uehling Instrument Company wit headquarters in their New York offic

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A. S. M. E. MEETING

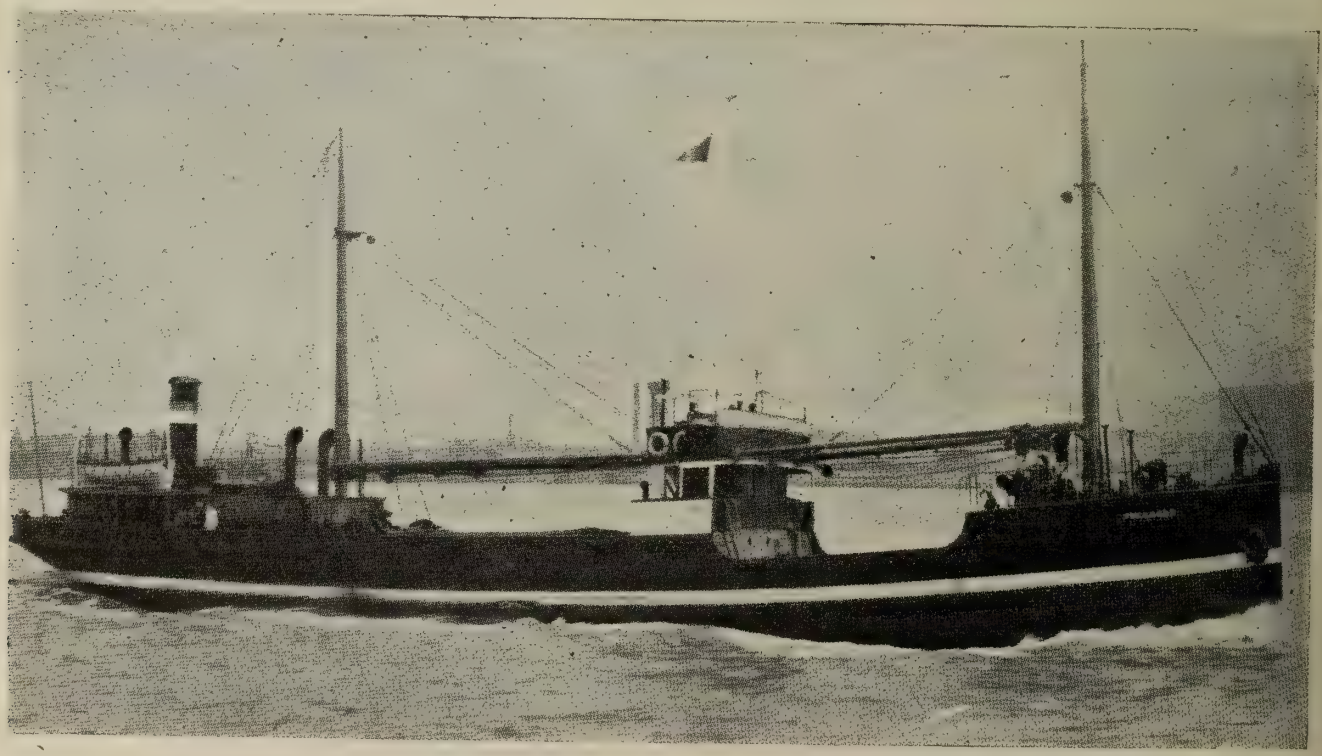
The 1920 annual meeting of the Ameri can Society of Mechanical Engineers wil be held in the Engineering Societie Building, 29 West 39th Street, New Yor City, from December 7 to December 1(

Sessions will be held on the subject of appraisal and valuation, and the ap plication of engineering to woodworking

The newly founded profession section on management, power, fuels, machin shop, railroads and textiles will als conduct sessions to consider the vita problems in their field. In addition number of valuable papers will be pre sented at general sessions.

A memorial session for Dr. Brashea is planned, as a fitting tribute to his lif and work.

Change Announced.—The company o G. & J. Weir (Canada), Ltd., has bee incorporated to take over the busines of the Clyde Engineering Co., and wil manufacture their complete line o marine auxiliary machinery and powe plant auxiliaries for land installations For this purpose land has been secure and work has been commenced for foun dry and machine shop in Montreal. Thi extension has been found necessary as result of the increasing demand for G & J. goods.



THE ELECTRICALLY WELDED SHIP "FULLAGAR," PROPELLED BY CAMMELLAIRD-FULLAGAR OIL ENGINE.

British Columbia

BRITISH COLUMBIA shipyards are not anticipating any more steel ship contracts in the near future as a result of a recent statement by S. J. Crowe, M.P. for Vancouver, to the effect that the Canadian Government has definitely decided to build no more steamers as the cost of construction is more than the cost of suitable steel steamers at the present time in the open market. According to Mr. Crowe, offers are coming from British shipyards of 8,800 ton steel steamships for $130 a ton, and recently an American Atlantic seaboard yard offered a Vancouver firm four vessels of similar tonnage for $150 a ton. The British offer, considering the exchange, would make it possible for American concerns to buy tonnage for about $100 per ton in the shipyards of Great Britain and for $212 in Canada. Canadian shipyards are obviously unable to build ships at this price and will therefore be out of the market until such time as the cost of labor and materials are considerably reduced.

In addition to one hundred vessels of 477,194 gross tons now in commission, the Nippon Yusen Kaisha has fourteen vessels, of 97,400 tons now under construction, according to latest advices from Yokohama. Three of these vessels are of 10,000 tons each, of the same tonnage as the big passenger liners now plying in the North Pacific trade. Of the other vessels under construction six are of 7,000 tons, two of 4,500 tons, one of 5,300 tons and one of 3,800 tons.

Word reached here a few days ago that the steam yacht Victoria, formerly the Dolaura, and until recently owned by the late James Dunsmuir, Vancouver Island coal magnate and multi-millionaire, struck on York Ledges, Maine, August 7, but was floated shortly afterwards. The vessel was bound from New York to Quebec and Montreal with her new owner, Arthur Meeker, Chicago packer, on board.

Hon. C. C. Ballantyne, Federal Minister of Marine, is expected to arrive in Victoria, August 23, making the westward tour by way of Prince Rupert and the Grand Trunk Pacific line. Plans are being made to give the Minister an opportunity of studying at first hand the shipping problems of the Pacific coast ports of Canada.

The American steamship Elihu Thomson, of the North Pacific Sea Products Company, has been sold to Peruvian interests at Callao and will be used as a trader on the South American coast. The steamer is well-known in Pacific Coast ports and was formerly owned by the Pacific Cold Storage Company, Tacoma. The North Pacific Sea Products Company, which has been operating the Elihu Thomson for about two years, is an offshoot of the Consolidated Whaling Corporation, of Victoria, which operates a fleet of whaling steamers.

With a view to building tug boats and barges, Captain A. Berquist, for some years engaged in tugboat operation in Victoria, has purchased a portion of the Foundation Company's wooden shipbuilding plant at Point Ellice, in Victoria inner harbor. Four shipways are included in the equipment bought. The Point Ellice property is well laid out for the purpose of shipbuilding and is equipped with sawmill, machine shops, blacksmith shop and offices. On the fourways the Foundation Company built ten of the twenty 3,000-ton wooden steamships ordered by the French Government, the other ten being turned out by the adjacent Point Hope yard.

The direct freight service of the Canadian Pacific Ocean Services, Ltd., between British Columbia and the Straits Settlements, inaugurated last October with the steamship Methven, will shortly be augmented by the steamship Mattawa, formerly engaged in the Atlantic trade. The Mattawa sailed from Liverpool April 23, via the Suez Canal, for Karachi, Bombay, Colombo, Singapore, Hongkong, Shanghai, Kobe and Yokohama. She was reported at Singapore a few days ago and should reach Victoria in the near future.

The launching of the twin-screw steamship Montcalm from the Clydebank yards of John Brown & Co., Ltd., July 3, adds still another floating unit to the C.P.O.S. fleet. Lady Fisher, wife of Sir Thomas Fisher, noted British shipbuilder, performed the christening ceremony at the launching. The Montcalm will be engaged in the trans-Atlantic business and is designed to carry about 2,000 persons in two classes.

Shipping firms here have been advised that the Holland-America Line, in association with the Royal Mail Steam Packet Company, will inaugurate a service between Rotterdam and San Francisco as soon as sufficient vessels are available, and that the service will later be extended to Puget Sound and British Columbia ports. The Holland-America boats will connect on this coast with the Java-Pacific line to the Far East. Before the war the Royal Mail Steam Packet Company operated a fleet of freight carriers between the United Kingdom and Victoria and Vancouver via the Orient.

It is probable that the Canadian Pacific Railway will place the contract for construction of a new steamship similar to the Princess Sophia with either Yarrows, Ltd., Esquimalt, or the Wallace Shipyards, of North Vancouver. The steamer will be engaged in the service between southern and northern British Columbia ports and Alaska points.

Dealing with the newly inaugurated Canadian Government steamship service between British Columbia and Australia, C. Hartlett, Canadian trade commissioner at Melbourne, writes: "Already two steamships of the Canadian Government Mercantile Marine, Ltd., the Canadian Raider and the Canadian Importer, have arrived at Sydney and Melbourne. These ships are to be followed by the Canadian Exporter and two other ships of similar size at regular monthly intervals. Apart from filling a long-felt want in the shipping facilities between Canada and Australia, these ships, in carrying cargo from the Commonwealth to New Zealand, are relieving considerable congestion existing for some time in Australian ports, and the available space is eagerly sought by shippers of Australian produce to both New Zealand and Canada. Upon her arrival in Melbourne the Canadian Importer was visited by a number of prominent Australian shipping men, and most favorable comment was made upon her design, her exceptionally clear holds, large hatches and powerful winches for the rapid loading and discharge of cargo."

The Canadian Government is asking for bids for the purchase of the former Rainbow and Niobe and the naval patrol ships Grilse and Canada. The cruisers are advertised as being suitable for cargo-carrying purposes, but ship experts believe that they will finally

Continued on page 217

The General Survey of Engines and Boilers

This Article Deals in a Descriptive Manner With the Work Necessary to Put a Ship's Engine Through Lloyd's or Board of Trade Survey

By T. H. FENNER

IN making an overhaul of the engines of a ship, the condition of the main steam distributing valves to the cylinders should be particularly noted. The smooth and economical working of the engines depends to a large extent on the proper setting and steam tightness of these valves. There are two types of valve generally employed on the vertical compounded type of engine, these being the slide valve to the cylinder over the outside edges, and allows the exhaust to escape through the centre orifice, while the piston valve admits steam through the inside edges, and exhaust is conducted away over the outside edges. The high pressure cylinder valve is usually of the piston type, while the intermediate valve is generally of the single ported balanced type, and the low pressure valve of the double ported balanced type. Sometimes in large engines the intermediate cylinder valve is also of the double ported type. High pressure valves in the early days of the compound expansion engine used to be of the ordinary slide type, sometimes fitted with a relief or balancing ring, and sometimes without. With the introduction of higher pressures the friction of slide valve due to the pressure on the back of it, and the consequent strain of the gear, became a serious matter, so that it became necessary to find means of relieving this pressure. This was accomplished by fitting a ring on the back of the valve, which shut off the larger part of its area from the high steam pressure, the part inside of the ring being put into communication with the condenser. This was followed by the introduction of the piston valve, which by reason of its construction, is a self-balancing valve. It really consists of two pistons, which are joined together by a narrow column or neck. The two ends fit accurately into the bore of the valve chamber, which is of course made cylindrical, and the high pressure steam is admitted in between the two piston ends, the pressure being thereby equal on each. Sometimes the pistons are fitted with spring rings, but very often they are made solid, with just a groove turned on the surface for steam tightness.

Examining a Piston Valve

The first step in overhauling a piston valve is of course to remove the top cover, which is just a round plate similar to the cylinder covers, but of course much smaller. If the valve is a large one the cover will be a ribbed casting, but if an ordinary sized engine, it will be a plain casting of sufficient thickness to withstand the pressure, which is of course only that due to initial pressure on the intermediate piston. The cover removed, the piston valve will be found secured to spindle by a nut with a cotter pin through the spindle above the nut. Sometimes a jam nut is employed as well, but mostly a single deep nut with a cotter pin or taper pin passing through nut and spindle. Eyebolt holes are provided into which are screwed eyebolts to lift the valve from the spindle, but here again the exercise of care and patience will be required as the valve is usually a good fit on the spindle, and considerable difficulty is often experienced in starting it. This is aggravated to some extent by the slack in the valve spindle end bearing, and the blocks which run on the link quadrant. A good way is to make fast the eyebolts to the stretching screw by means of a couple of chain slings, and take up the slack of the motion with the stretching screw. When all is taut, a couple of sharp blows on the spindle end, interposing a piece of copper to prevent damage, will often succeed in starting the valve. If this does not work, place a strong back over the top of the valve chest, and screw two studs into the valve passing through the strong back. Nuts are then placed on the studs, and screwed down, at the same time tapping the spindle end with short sharp blows keeping a strain on the nuts. I have seen a valve started by turning the engine down when the strain has been taken on the studs passing through the strong back, but am not in favor of the method, as it is a case where something has to go, and if the valve does not start, it is easy to break something. Patience, and the use of plenty of coal oil, will bring success and even if a little more time is consumed, nothing is damaged. Once the valve is started, it will come off the rest of the way in comparative ease.

Having got the valve off the spind

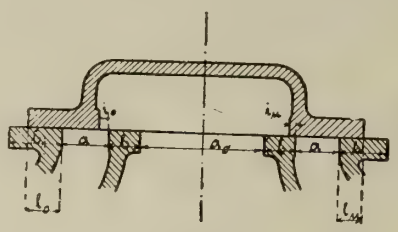


Fig. 156.

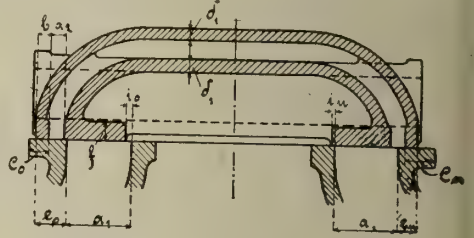
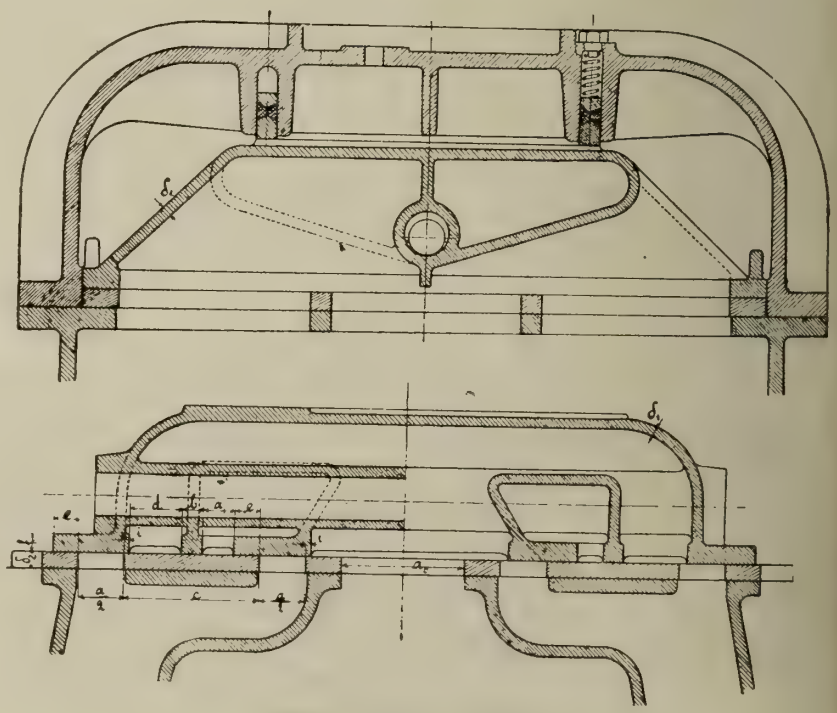


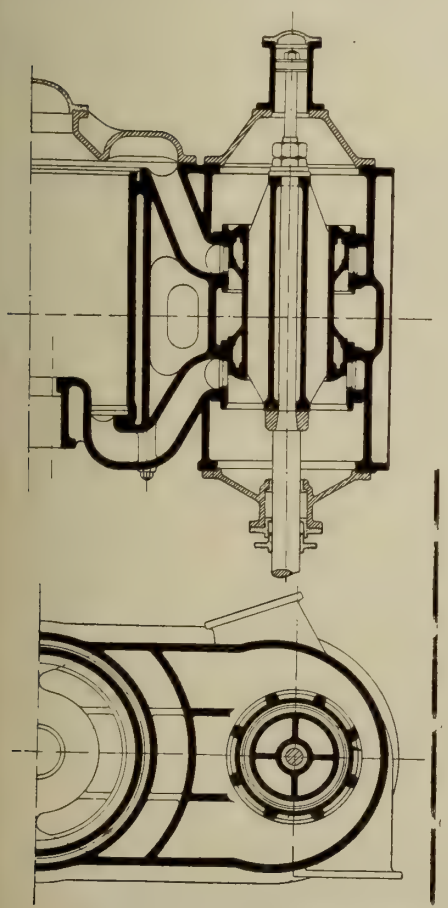
Fig. 157.



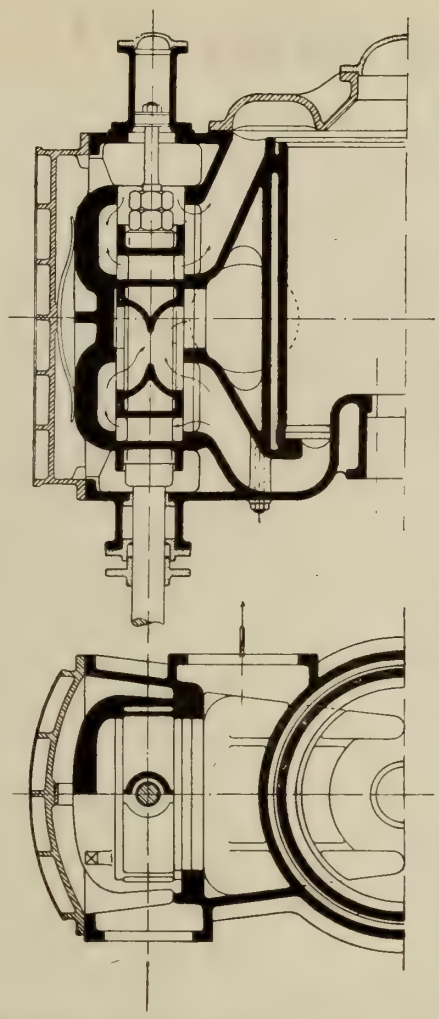
TYPES OF SLIDE VALVES.

and landed on the platform, the liner can be examined. If the piston ends of the valve are sufficiently long to over-run the edges of the liner at each stroke there will be no danger of ridges forming at the end of the travel. If not the same effect as is observed at the bottom of the cylinder bore may occur and a ridge be formed which must be removed. The spindle should be examined near its entrance to the nick bush for grooving, and it is just as well while the valve is off to disconnect the spindle end at the block on the quadrant, and lower it down till the part that runs through the spindle is exposed. It can then be thoroughly examined for wear, and if necessary trimmed up with a smooth file. If worn beyond the possibility of trimming up in this way, it can be sent ashore to be turned up. If this has to be done, it may be necessary also to remove the neck bush, and replace it with one made to fit the spindle after turning. This may be avoided by fitting a brass washer below the neck bush for the packing to rest against, turned to a neat working fit of the spindle. Packing will never stand on a spindle which runs slack in the neck bush, as it gets drawn up by the spindle into the clearance between spindle and bush, and frayed out. Of course if metallic packing is fitted, there is no danger of this.

If the piston valve is fitted with spring rings, these should be removed, cleaned and tried into the piston valve liner in the same way that the piston rings are tried in the cylinder. They should be tight enough to hold up their own weight, and be movable up and down the liner by hand. If the valve is a solid one, it can be trued in the same way when the spindle is out. The liner should be calibered, or gauged, to see that it is round. A good way to test a piston valve is to place it in mid position with the cover removed and steam on the boilers. Then open the stop valve very gently, leaving the drain on the intermediate receiver open. If the valve is tight, no steam will pass either through the open cover or the intermediate drain. Of course this cannot be done when the overhaul is taking place, as there will be no steam on the main boilers and it would make things unpleasantly hot if there were. A badly worn liner can be removed by drawing it out from the chamber by means of a strong stud and nut, the stud passing through a strong plate placed across the bottom edge of the liner, and a strong back over the top of the valve casing. It is not often that trouble is experienced with wear of piston valves and liners, as the valves work up and down with the minimum amount of friction. If everything in the ship gave as little trouble as the piston valves there would be a good time for the sea-going engineer. The examination referred to above having been completed, the spindle may be put back in place, and the valve dropped over it and secured. There is still one more job to be done, and that is to check up the setting of the valve. As none of the port edges or at least only one of them, can be seen, this may, to the novice, present a point of some difficulty. However this may easily be overcome, as we shall see. In our next article we shall explain the method of making staffs and setting valves as it is done when the ports are not accessible to direct vision.

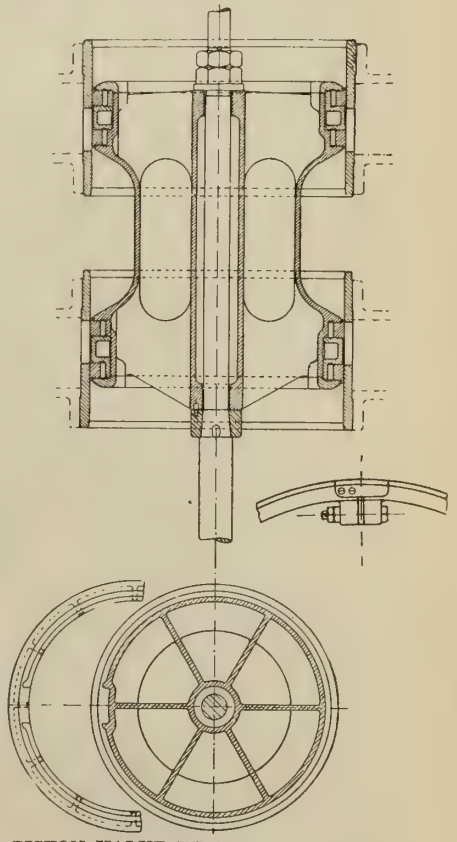


PLAN AND ELEVATION OF PISTON VALVE.



SLIDE VALVE WITH COVER. AN UNUSUAL TYPE.

Uehling Instrument Co., 71 Broadway, New York, has just issued Bulletin No. 111 describing style U Uehling CO_2 equipment. This is a new design built in single and multiple forms, the latter serving any number of steam boilers simultaneously, up to a total of six. The purpose of this equipment is to save fuel by burning it with the proper air supply. Neglect of this factor is costing power plant owners heavily. Among the notable features of the new machine are speedy action, resulting from a new form of aspirator, absence of chemical solutions, greater simplicity and the unique plan of providing an auxiliary boiler front CO_2 indicator, which guides the fireman, while the CO_2 recorder, installed in the chief engineer's or superintendent's office, makes a continuous (not intermittent) record, showing all changes in boiler adjustments that are conducive to either waste or economy.



PISTON VALVE WITH ADJUSTABLE RING.

MARINE ENGINEERING

AND

Canadian Merchant Service Guild Review

A monthly journal dealing with the progress and development of Merchant and Naval Marine Engineering, Shipbuilding, the building of Harbors and Docks, and containing a record of the latest and best practice throughout the Sea-going World.

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A Woman Salvage Operator

A REPORT comes from Detroit that Mrs. Margaret C. Goodman, the only woman salvage operator in the world, is about to make an attempt to salve a cargo of walnut and white oak logs that have been under water since 1859. They were the cargo of a schooner that sunk with all hands in that year, and presumably the schooner and its contents are intact. Mrs. Goodman has already had success in her field of operations, as she was the organizer of the company that recovered the copper cargo of the steamer Pewabic. It is said that one piece of copper from this cargo sold for $3,500. The whole cargo was worth a very large amount of money. Mrs. Goodman, it is understood, is prepared to carry out all sorts of salvage work, and her company uses the very latest appliances, including a reinforced diving suit, which permits diving to great depths. The Pewabic lies in 180 feet, or 30 fathoms of water. It is not very long ago that this depth precluded all thoughts of salvage, as the greatest depth at which a diver could work was about 25 fathoms, or 150 feet. There were comparatively few divers who could remain at this depth for any length of time, as they had to be men of exceptionally strong physique to withstand the pressure. As every 2.305 feet depth is equal to one pound pressure above the atmosphere, a depth of 180 feet means that the pressure per square inch will be in the neighborhood of 80 lbs. per square inch. In the ordinary diving suit, of flexible material, the suit offered no resistance of itself to this pressure. The air inside the suit had to be kept at the pressure corresponding to the depth at which the diver was working. It can be readily seen that the pressure a man could stand would depend on his heart and lungs being of a robust type. With the more modern diving suits, a certain amount of rigid material is introduced, so that a portion of the pressure is borne by the suit itself, and in some cases the suit can withstand the total pressure. The diver is then only subjected to the ordinary atmospheric pressure or something very slightly above it.

It is a strange thing to see a woman in the salvage game, because women are not generally supposed to be good gamblers, and the salvaging of sunken ships and cargoes is very often in the nature of a gamble, with the odds against the salvor. Many a time complete failure has ensued at the very moment that success seemed assured. The writer recalls a case which is a very good instance of this. An English company undertook the salvaging of a ship which was ashore on the West Coast of Africa, in a very exposed position, and very far removed from any local base of supplies or civilization. The wrecking crew were taken to the scene of the wreck in the salvage steamer, and supplies for several weeks were taken with them. They lived aboard the wreck for a large portion of the time, in almost incredible discomfort, bothered by rats, insects, and snakes. Work was pushed at the utmost speed to try and have everything ready for floating before a heavy blow came on. At last one night saw everything in readiness for an attempt to float the next morning. The broken plates had been repaired with temporary wooden bulkheads, water was all pumped out, cables had been run out to kedge anchors offshore to assist the salvage steamer's efforts to pull the vessel off the beach. With the going down of the sun that night the wind freshened, and the swell, always heavy on that coast, began to increase. It blew hard all night, and both sea and wind increased with the coming of daylight. The close of that evening saw the vessel a hopeless wreck, battered to pieces by the heavy surf, and utterly impossible to salve. One night's wind upset the work of months, and left the salvage company with a loss of many thousands of pounds. It would require a very game woman to go through an experience like that, and be willing to try it again, but this is not by any means an isolated case in the experience of ship salvage companies.

Our $4,000 Legislators

DURING the debate on the Government's proposals to finance the building of foreign ships in Canadian yards by the endorsement of the purchaser's notes, some airy persiflage was introduced by our high-priced legislators. Mr. Duff, one of the members from the Maritime Provinces, was opposing the proposals, and Mr. Morphy asked him if the inclusion of the wooden shipbuilding yards would cause him to look more favorably upon them. Mr. Duff answered that the Government should not pick out any particular industry for their favors. Mr. Morphy again put the direct question that if the Government had included the wooden shipbuilders, would Mr. Duff have given the Government his support? Mr. Lalor chimed in with, "Come on, that's the second time." To this Mr. Duff answered in cryptical fashion, "Pork and beans make a very good meal if there are no stones in them, as the honorable member should know." Here the Deputy Speaker asked the members to assist the Speaker to preserve the dignity of the house. Mr. Duff thereupon asserted that the shipbuilders of Nova Scotia had not asked for assistance, and believed in standing on their own feet. Mr. Morphy asked if the wooden shipbuilders would refuse assistance if offered them. Mr. Lalor again interjected "Come across." Mr. Duff again answered by his former allusion to pork and beans, and Mr. Lalor came back, "You have enough wind. You do not need any beans."

Such is the high level at which the debates are kept by our parliamentary representatives. However, probably $4,000 a session is not so very much to pay them for exhibiting such a pretty talent in patter. Look at the money Charlie Chaplin makes, and he is not so very much funnier, and probably not as vulgar.

News of The Shipping World

The Charter Market

THE freight situation at the end of July and the beginning of August remained fairly easy. There is a large amount of tonnage offering, and owing to various causes, not any great amount of cargo to fill the space. There are many reasons for this, one of them being the coal export embargoes which have been put into force in the U.S. and Canada, though it is thought that vessels already chartered before the embargoes came on will be loaded by means of a license. The South American, Mediterranean and Eastern markets all show a decline on homeward freights. The outward markets do not show any great strength, tonnage being freely offered. What may tend to a better distribution of tonnage is the fact that coal is now available for export from the far East, South Africa and Australia, India also being in the market to supply coal to Europe. This demand for tonnage will be easily met, but it will draw tonnage to these widely separated centres and relieve some markets which are liable to be overstocked with ships. Practically every European country is looking for coal, and some fixtures have been made at fancy prices for Newcastle, N.S.W. to Northern European ports. The homeward market from the River Plate to United Kingdom is getting stronger, as the time for exporting maize comes near. Tonnage that is available for prompt shipment can command the best prices, but there will be no shortage of ships, as these can soon make the run to Buenos Ayres, etc., in ballast from European or North American ports, when the demand is strong enough to warrant them. Rates for September loading River Plate to U.K. are about 85 shillings, while to Mediterranean ports, 95 shillings is quoted. Some fixtures have been made at this rate. The rates from Canada and Northern U.S. ports to United Kingdom for September loading are from 11s. to 11s. 6d. per quarter. Deals per standard from New Brunswick ports to U.K. 190 shillings per standard.

Some representative fixtures are as follows: Steamer, 3,000 tons from U. K. to Antwerp, August loading, fuel, 25/- per ton. Steamer, 400 tons, Tyne to French range of ports, 27/6. 2,300 tons steamer Welsh port to Lisbon, August loading, 32/6. From Wales to Mediterranean ports fixtures have been made from 25/- to 37/6, according to port of discharge. 6,400 ton steamer, from Welsh port to Alexandria, August loading, 35/-. From Wales to Genoa, a 3,000 ton steamer, 32/6. The 25/- fixture was for a steamer from Tyne to Oran. To Rio Janeiro from Welsh port a steamer has been fixed at 40/-, August loading, while to Buenos Ayres two steamers, one of 5,200 tons, and one of 4,000 tons, have been fixed at 37/6.

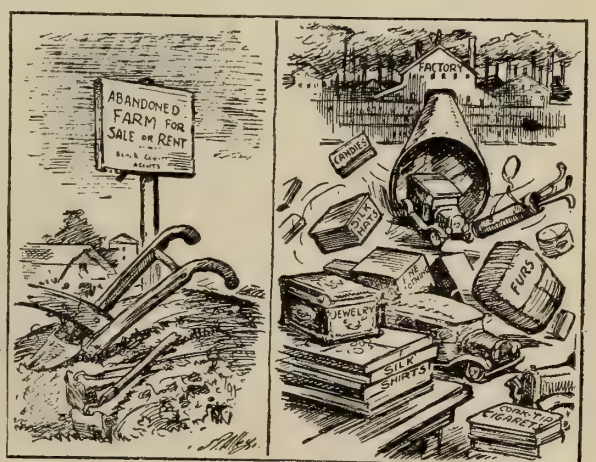
Fixtures from North America and Canada to United Kingdom and Continent are represented by the following: Steamer Miramichi to Manchester, 1,200 standards at 180/- per standard. Steamer, 1,200 standards from St. John, N.B., to West coast of Britain, 190/- per standard. For September loading the Maresfield, 28,000 qtrs., has been fixed at 11/6 from a northern U. S. port to U. K. and another steamer for 25,000 qtrs. from same port and to same destination at 11/6. Several steamers from 4,000 to 7,400 have been fixed from Southern U. S. ports to Continental ports at rates varying from $13 to $16.50, according to port of discharge, while for a 6,500 steamer Virginia to Buenos Ayres $10 has been effected.

From Australia to United Kingdom or Continent a steamer of 7,000 tons for September loading has been fixed at 135/-, and the same rate has been done from Java to Marseilles or Genoa. From Bombay to U. K. or Continent with two unloading ports, 75/- and 80/- has been effected for two steamers, 3,500 and 4,000 tons.

The coal situation is one of considerable interest, Great Britain, which was the greatest coal exporting nation in the world, has had her available supply for export cut down enormously, and not only that, but faces the unprecedented competition of her own Dominions. South Africa, India and Australia are all offering coal to European nations, as are also Japan and the United States. Just at present, however, the United States is in the same fix as Great Britain, and has had to put an embargo on exports. It is vital to the prosperity and even the continued existence of Great Britain that she should get back to her pre-war basis of coal exportation. That gives employment to her ships, and also brings the ships of every nation in the world to her ports, with cargoes of raw material, which they exchange for cargoes of coal. It is interesting to note then that the miners in Great Britain have demanded a reduction of 14/2 a ton on domestic coal, or a further increase in wages to be paid for out of export coal. This seems an impossible position to take, more epecially as it is because of the continued demands of the miners that coal has reached such a price as it now stands at. They are now taking a ballot on the question of a general strike, which, if it is decided on, will come into effect at the end of this month. This will mean a further tie up of the coal trade, and, of course, will seriously affect the shipping trade, as there will be no coal cargoes for export. This will mean that ships will have to make all their outward voyages in ballast. Probably a large number would tie up, there being nothing else for them to do, faced with high bunkering charges and outward voyages in ballast.

Lord Pirrie in a recent interview said he saw no limit to the size of motor ships. Although his firm have up to the present not built these engines in larger size than 3,000 h.p., they are at present preparing plans for larger sizes than this. He did not think there was any question of a shortage of oil fuel in the future, provided that the fuel was used with reasonable efficiency, and not wasted. The more plentiful supply of oil tank vessels would ease the situation in his opinion. That the internal combustion engine was now perfectly reliable he had no doubt, and in this connection stated that their firm's oil engine works would be doubled in the near future.

On the "Aquitania's" last outward voyage the birthday of the captain, Sir James T. W. Charles, K.B.E., C.B., R.D., R.N.R., was celebrated by the passengers subscribing £500, which will be devoted to a bed in his name at the Liverpool Seamen's Orphanage.



PROSPERITY!
—Alley in the Memphis "Commercial Appeal."

PROGRESS IN NEW EQUIPMENT

There is Here Provided in Compact Form a Monthly Compendium of Shipbuilding and Marine Engineering Auxiliary Product Achievement

WATER LEVEL INDICATOR FOR BOILERS

The ordinary method of checking the water level in a steam boiler by means of test cocks has the disadvantage that with such pressures as are now in use the fluid issuing from the cocks, when they are open, is in the form of a jet which is practically the same whether the water level be above, or below, the test cock. Partly in view of this it has long been usual in good practice to fit two water-level gauge glasses instead of one. Even so, however, it is possible that the two glasses may be out of action at once, and in some cases it is not always easy to distinguish between a full glass and an empty one. A simple and effective form of water-level indicator which has all the advantages of the test cocks in checking the water level, but does not suffer from their disadvantages, has been patented by Messrs. Cammell Laird and Co., Limited, and is being manufactured by Messrs. Bromel Patents Company, Limited, of 64, Darnley-street, Glasgow. It consists of a metal tube of external diameter and length such that it may replace the glass tube in any ordinary water gauge. The metal tube is drilled with a series of small holes about 1-32in. diameter, and at a pitch of a few inches apart.

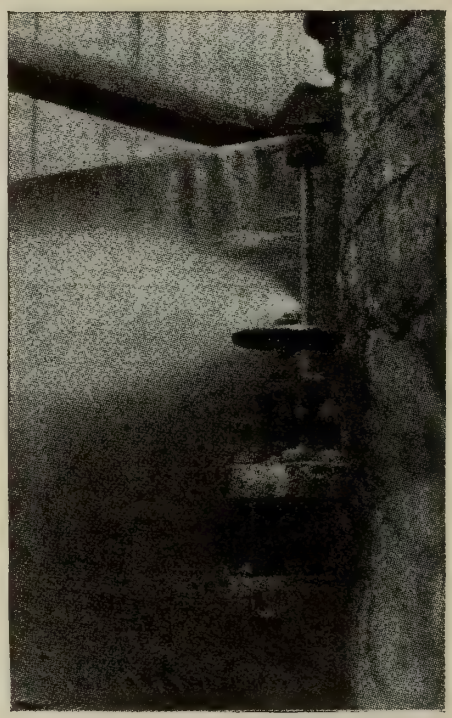
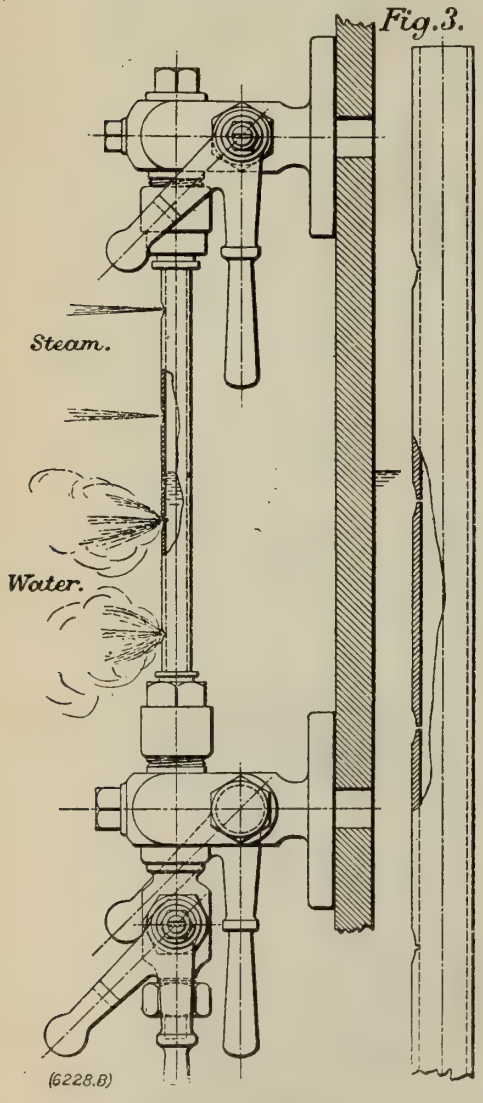


FIG. 1.

When the tube is in position on a boiler and the gauge cocks are open so that it is put in communication with the water and steam spaces, it is found that the jets which issue from the holes which are below the water level are very distinct in character from those which issue from the holes above the water level. The steam jets issuing above the water level are barely visible and have a very small angle of divergence, while the jets below the water level are in the nature of a distinct white, cloudy spray, and have a wide angle of divergence. This is illustrated in Fig. 1 which shows an indicator in operation. It will be clear that this device enables a very close reading of the water level to be obtained with ease and certainty, and that there is nothing in it to go wrong. A hole may be stopped up, but if this happens it is at once evident and may easily be cleared. With the size of the holes used, 1-32in. diameter, this minor trouble is not very likely to occur. It is found that the best contrast between the jets is obtained when the length of the jet passage is equal to its diameter, and to obtain this proportion a flat is filed on the tube at the point where the hole is drilled. This is indicated in the general drawing, Fig. 2, and the detail of the tube, Fig. 3. It will be evident that these distinctive jets may be obtained by fitting suitable nozzles to ordinary test cocks, but the arrangement would not give the close reading of water level which is obtained with the indicator, unless an unusual and probably undesirable number of test cocks were fitted.



FIGS. 2 AND 3.

BRITISH RANGE FINDERS FOR MERCHANT VESSELS

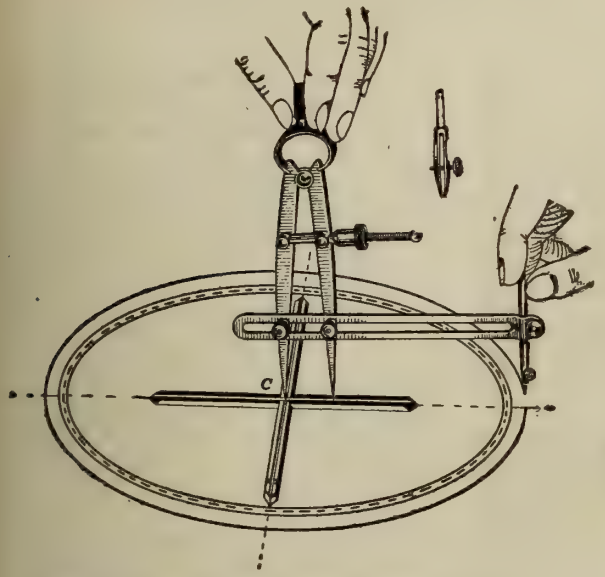
Range finders were first developed for naval and military purposes, but they are now coming into use on merchant vessels. The conditions laid down by the British Admiralty in 1892 for these instruments were that they should give rapid readings of distances with an error of not more than 3 per cent. at a range of 3,000 yards. This high degree of accuracy seemed almost impossible in an apparatus which had to be compact, able to stand all weathers, and unaffected by rough usage and vibration. Nevertheless British inventors succeeded, and their invention is readily adapted for use on ordinary vessels. Its advantages are many. It gives, in a few seconds, the exact distance of any lighthouse, rock, buoy, or other object, thus enabling the navigating officer to check his guesses, which are frequently very wide of the mark owing to atmospheric and other conditions. By taking a series of observations on fixed points the range-finder enables the course of the ship to be rapidly plotted. The speed of the ship, or the rate of the tide past a moored vessel, can also be learned by taking the range at intervals of a barrel or other mark dropped over the stern. Accurate records of speed during trials on the "measured mile" can also be taken by the range-finder. In many other ways this apparatus, which is not much larger than the largest portable telescope, provides an aid to safe navigation

OPTICAL INSTRUMENTS

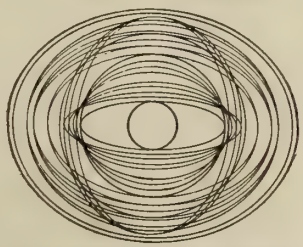
Optical equipment for the inspection of flat surfaces and the comparison of standards, is a line of tools now being placed on the market by the Van Keuren Company of Boston, Mass. By means of these instruments comparisons can be made to one-half a wave length of light, which for daylight is approximately 0.00001 inch. It is claimed that the working flats of the set will register an accuracy of 0.000005 inch and that of the master flat to within 0.00000025 inch. Full instructions are included with the instruments and the equipment is intended for shop use.

REID ELLIPSOGRAPH

Daniel C. Reid, 2717 N. Croskey Street, Philadelphia, Pa., has placed on the market what is known as the Reid Ellipsograph. This instrument is claimed to draw all kinds of ellipses or ovals, from 1½ in. up to 12 in. major axis, and describes a perfect ellipse in one operation.



THIS VIEW SHOWS THE INSTRUMENT IN USE.

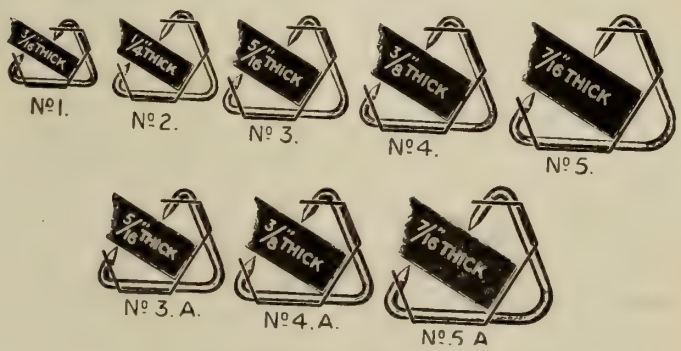


THE WORK ACCOMPLISHED

The instrument is provided with pen and pen parts, and can also be used for drawing circles up to 12 in. diam. It can also be used as an ordinary divider. This announcement will no doubt appeal to draftsmen, designers, illustrators, architects, etc. To illustrate its construction we show the illustrations herewith.

UNIVERSAL BELT FASTENERS

An improved type of belt fastener, known as the "Universal," has been placed on the Canadian market by the Climax Company, of 244 Lemoine Street, Montreal. These fasteners are the result of careful study and exhaustive experiment on the part of the makers, and are universal in character. They are equally efficient in rubber, balata, leather or cotton belting, and are made in six-inch lengths, of sizes varying to take belts from 3-16 to 7-16 inch in thickness.



VIEW SHOWING THE VARIOUS SIZE HOOKS.

The individual hooks are held in position by a metal frame which retains the hooks in the same relative position all the time the hooks are being forced into the belt. When the hooks are flush with the belt the frame slips off freely. The fasteners are made in two gauges of wire, the larger sizes being adapted to meet the requirements of the user who has extra heavy belts running over small pulleys.

On the intermediate fasteners the wire can be laced into the belt with a simple hammering tool, economically and efficiently. For the larger sizes, a special lacing machine is preferable. On the smallest sizes, the lacing can be performed by using a hammer and a wooden block, the metal frame assuring perfect alignment during the operation. The great advantage of the metal frame is that it prevents the hooks from twisting to one side or the other while being forced into the belt. The fasteners are made with a series of hooks having long and short legs, the short legs entering the belt on the pulley side, this method minimizing the metal contact on the pulley and reducing the possible slip. The hooks do not meet in the belt, but are individually staggered, thus increasing the effective pull.

The fasteners can be cut to any desired length without fear of wasted ends, as the metal frame keeps the pieces intact. A pair of narrow scissors are provided for cutting the metal frame.

VIEWS SHOWING INTERMEDIATE MACHINE AND OTHER DETAILS.

THE HEAVIER TYPE MACHINE.

We have received Bulletin B-410 of the Yarnall-Waring Co., describing the Yarway seatless and Yarway double tightening blow-off valves. There is an interesting diagram showing the cost of leaky blow-off valves. This shows by means of a curve loss in water and coal in dollars per month and per year, and water loss in thousands of gallons per month. These valves are constructed to conform to the A. S. M. E. standards, The double tightening valve was originally made to use in conjunction with the Yarway seatless valve in places where the boiler laws require the use of two valves. Anybody interested in blow-off valves can obtain a copy of the bulletin by requesting one from the makers, Yarnall & Waring Co., Chestnut Hill, Philadelphia.

Want To Get Heat.—A strong committee has been appointed by the Board of Directors of the Chamber of Commerce of Chatham, to meet representatives of the Chatham Heating Co. The object of the committee is to try and prevent a repetition of last year's experience, when business suffered to a considerable extent due to a lack of heat, which it is claimed the company failed to supply.

Enquiries Into Marine Disasters

RE S.S. "HAMONIC" STRANDING

In the matter of a formal investigation held in Sarnia, Ontario, on July 21, 1920, into the grounding of S.S. "Hamonic" off Hardwood Point, Lake Huron, on July 7th, 1920, before Captain L. A. Demers, F.R.A.S., Dominion Wreck Commissioner, assisted by Captain C. E. Millard and Captain W. A. Glass, acting as Nautical Assessors, both having extensive lake navigation experience.

Colonel R. I. Towers, K.C., represented the interests of the Northern Navigation Company.

Captain Oscar Matthew Wing, Certificate No. 6939, sworn, stated that he had been in command since 1913, having no accident previous to this one; that the "Hamonic" is a single screw, triple expansion engines, is steel built, carrying a crew which varies in numbers, having two duly certificated officers. She is 365 feet in length, 50 feet beam, 3295 tons net, 5265 tons gross, and was drawing 17 feet 3 inches aft and 9 feet forward at the time of the casualty.

On the 6th July up to 10 p.m. he had occasion to alter course in order to counteract a leeway caused by a strong breeze blowing off the port side; that his compasses were but imperfectly adjusted in the spring, as a result there was an error which he had found by observing ranges; that the towing log had a new propeller from the beginning of the voyage, and he had not the opportunity to verify whether its running was accurate or if there were a loss or gain The sounding machine was in order, and had been used some three voyages previously; but was not utilized on this occasion, stating as one reason that one of the crew would have to be called from his sleep. He had no order to break any rules of navigation to observe his schedule; but on the contrary his instructions were to adhere strictly to navigation laws. He was advised by his second officer that he passed the "Huronic" inside, or on his starboard side, assuming from that he was steering a right course, and was in a proper position as to location. The second officer called him when haze or fog came on, with the information that he had seen a light once; but had not time to take a bearing. He never heard the fog horn at Port aux Barques, but kept on his speed nevertheless until the ship struck.

When soundings were taken it was found there were 18 feet forward and 16 feet aft, while interior soundings revealed a leak in No. 1 hold. The ship was released on the evening of the 7th by tugs. There was no wind at the time of the casualty, and none was experienced from 10 p.m. of the 6th until the ship struck at 12.17 a.m. on the 7th.

Andrew Allan, Second Officer, Certificate 8647, deposed that he was on the bridge from 5.30 of the 6th, his watch ending at 12.30 of the 7th. He called the master when fog came on, and reported having seen a light which he assumed was Port aux Barques light. The ship was steered correctly, he looking at the compass every ten minutes. He did not offer any suggestion as to reduction of speed or soundings, assuming that the captain was the master of the situation. The master had been about the deck frequently.

Albert James Galloway, wheelsman, testified to the good steering of the ship, but said that before ten she carried a weather helm. He endeavored to counteract the falling out to the westward by making allowance to the eastward of the course.

When the Court had heard the evidence of the master, after consultation with the Assessors he was recalled and notified that on his own evidence the court would likely find him in default, and deal with his certificate, that if he wished to make a defence and secure the services of counsel that the Court would adjourn; but he elected to leave the case in the hands of the court.

Further testimony was deemed unnecessary, to which counsel for the Northern Navigation Company agreed, and the court adjourned sine die to give a finding.

Report

The master gave a very straightforward honest evidence, and narration of incidents prior to and at the time of the casualty.

Owing to the fact that he had observed that his compasses had been acting differently than heretofore, that his alteration of courses to counteract a leeway occasioned by which was done without actually observing if it met the needs at that particular moment, his assertion that he did not know the effectiveness or accuracy of his log, the fact that a light was seen but disappeared without a possibility of ascertaining its nature and bearing, moreover, not hearing the fog horn of Point aux Barques, were all reasons and causes which should have awakened an element of doubt in his mind and occasioned him to sound and slow down in order to ascertain his position and whereabouts, which action was but an elementary practice of safe navigation.

The fact that he had, besides the property, some 300 passengers and over 100 of a crew, should have caused him to exercise ordinary caution, in which he failed.

For the above reasons the Court cannot arrive at any further conclusion than that he failed to adopt and exercise that caution demanded from all navigators.

With regard to the second officer, his statement to the master that he had seen Point aux Barques light was misleading, and undoubtedly impressed the master, but no blame can be attached to him for that reason. His idea for not making any suggestion with regard to soundings or diminishing speed, that the captain was there and was master of the situation must be accepted by the court, as it seems to be the guiding rule of all young officers, yet in principle it is wrong. Officers' duties are to help the master, and share with him the responsibilities which devolve on each and every one.

Therefore, a suggestion would be in order: if the officer is awake to his responsibilities. Youth and obvious inexperience must be taken into account.

Finding

The Court having carefully weighed the evidence adduced, finds, for the reasons given in the report, the master, Oscar Matthew Wing, in default.

The Court does not consider the accident due to an error of judgment, or careless behaviour, but to an omission to exercise the necessary caution.

Owing to his youth, clean record and straightforward evidence, the Court will exercise leniency and will but suspend his certificate No. 6939, for a period of two months from July 21st, 1920, to September 20th, 1920, inclusive.

The second officer, Andrew Allan, is exonerated but cautioned that his responsibilities and duties demand more than to call the master and pace the bridge.

Read in open court at Ottawa this 22nd day of July, 1920.

Signed, L. A. Demers, Dominion Wreck Commissioner.

Concurred in

Signed, C. E. Millard, W. A. Glass, Assessors.

RE S.S. "MAPLEHURST" AND "BROOKDALE" VS. TUG "MARGARET HACKETT"— "GLADYS H"

In the matter of a formal investigation held in Montreal, P.Q., Wreck Commissioner's Court Room, on July 23rd, 1920, to inquire into the causes which led to the collision between the tug "Margaret Hackett," with barge "Gladys H" in tow., and barge "Brookdale" in tow of S. S. "Maplehurst," at or near buoy 25, in Lake St. Peter, about 3.20 p.m. July 16, 1920.

The court was presided over by Captain L. A. Demers, F.B.A.C., Dominion

Branch Commissioner, assisted by Captain Charles Lapierre and Captain C. J. Stuart, acting as Nautical Assessors.

The George Hall Coal Company, owners of tug "Margaret Hackett," were represented by Mr. A. R. Holden, K.C., whilst Mr. C. A. Damara, K.C., appeared on behalf of the Canada Steamship Lines, Limited, owners of the S. S. "Maplehurst" and barge "Brookdale."

REPORT

Tug "Margaret Hackett"

Analyzing the evidence, which was very contradictory, but which on the whole, can be summed up briefly, it is found with respect to the doings of the tug "Margaret Hackett," prior to the collision, that she was steered by a certificated master, who was engaged as mate, and therefore did not require, according to regulations, to be certificated. He was also in the wheelhouse, a deck hand was about the deck, the master who had kept his watch was then asleep, the management of the tug and tow being left entirely to the mate, who had been told to call the master when needed.

The lights of a steamer were seen, carrying, it is said, one masthead light and sidelights, burning brightly, then the attention of the mate, Ovilon Portelance, was attracted and concentrated on a steamer coming down exhibiting many lights, till within a short distance from a vessel which was proved to be the "Brookdale," exhibiting a green light burning brightly; but this light when seen did not cause the mate to take action excepting to sound a four blast signal, keeping the helm amidships and the engines going at the same speed.

The whistle failed to awaken the master, he getting up only when called by the mate a brief interval before the collision, he, the master, having but touched the wheel when the collision ensued.

The mate said when he saw the green light of the "Brookdale" he thought it was a sailing vessel, and meant to cross, but upon discovering it was a tow he intended to break the tow line. This is what the court gathered from his evidence.

If he did not see the two masthead lights of the "Maplehurst" bow how is it possible that he could discern the rope in the dark when he failed to note the "Brookdale" was not a sailing vessel. However, whether the "Maplehurst" had not two masthead lights was not a reason to attempt to break the tow rope, nor to cross ahead of a sailing vessel.

At the short distance the "Brookdale's" green light was seen, with such a small vessel as the "Hackett" a hard-to starboard helm would have caused her to deviate instantly and sufficiently to clear the "Brookdale," jointly with the four-blast signal the "Gladys H" would also have swerved and followed the tug's wake. Even if the light was seen too late, a hard-to starboard helm, and full speed astern on the engines were the necessary movements to be executed.

The Court cannot conceive that such stupid customs could be performed by one who six or seven years ago obtained a certificate to command a tug.

Besides maintaining his course and speed when the rules of the road implicitly state that a steamer must keep out of the way of a sailing vessel, Art. 20.—as it was surmised for a while that the "Brookdale" was such,—and also contravening a rule which states that a down bound vessel, impelled by a current has the right of way, he disregarded the injunction of the master to call him when necessary. The necessity of calling the master was obvious when the green light of a supposed sailing vessel was first seen on the port bow. This is not a crossing rule. The "Maplehurst" was in the channel whilst the tug "Hackett" was not,—Art. 25,—but had come across a short cut not frequented by deep draught vessels. If the position of the "Hackett" could be continued as being in the channel she would be held in default for being on the wrong side.

The result of the carelessness shown in the handling of the "Hackett" is that the "Brookdale" is damaged, to what extent is immaterial to this court, and the tug "Hackett" was sunk in deep water.

It may be reasonably asked why did the master, Allison, when, on observing that his vessel was rapidly filling, choose to sail his tug where depth was the greatest. The court has enquired into that phase of the casualty and has come to the conclusion that poor judgment was shown by the master, or his knowledge of the river is vague. The court entertains the former opinion, that of poor judgment.

Therefore, the "Hackett" failed to observe Articles 20, 22, 23, 27 and 29, also Regulation 14 of the rule for the Port of Montreal for which she is liable to a fine of $40 and costs; also for altering buoy 25, which carries liability to a fine of $200.

S.S. "Maplehurst"

The decision of the court hinges as to whether the "Maplehurst" did exhibit the two masthead lights, showing that she was towing.

Basing itself on some decisions already given in British inquiries in similar cases, where evidence was contradictory, the English Courts have accepted in preference the evidence of those who have lighted and placed the lights rather than those who, from any distance, failed to see them.

Without having to refer to the English Courts' decisions enough evidence has been adduced from the "Hackett" and "Gladys H," to show that very little attention was given to the navigation of both these vessels. There were but the mate of the "Hackett" and wheelsman of the barge "Gladys H" who could have possibly seen the lights of the "Maplehurst." The mate of the "Hackett" was giving his attention to another steamer well illuminated, while the wheelsman of the "Gladys H" had no interest in watching the nature of the lights excepting to steer his barge by the stern light of the tug which was towing. The view of the so-called mate of the "Gladys H" was obscured by the deck cargo, as the wheelsman said that the mate was sitting down in the wheel house.

On the other hand the witnesses of the "Maplehurst" positively assert that the lights were up, the master had seen the construction of the box, as did the mate, while the second officer has pointed out in detail how it was arranged and secured in a proper position.

All responsibilities were left to the tug, so that in view of that evidence the Court is of the opinion that the two lights were exhibited.

Now comes the question as to whether the so-called emergency oil lamp placed beneath the usual masthead electric light was constructed in such a way as to exhibit with the masthead light an illumination sufficiently strong to be seen at least five miles.

Clause Two of the Regulations for Preventing Collisions states that the "International Rules of the Road are applicable to the waters of Canada."

The Court giving benefit of the doubt to the "Maplehurst" with respect to the additional light, after examination of that emergency light, finds that such diameter of lantern could not meet with the requirements of Article Three of the aforesaid rules, and be seen at a distance of at least five miles on a clear dark night. The weather in this instance was clear and dark.

The benefit of the doubt is also granted with regard to the effectiveness of the improvised box enclosing the lantern.

The lantern examined is only an anchor light, and can only be used as such, and cannot give an illumination at a greater distance than two miles. There must have been a doubt in the mind of the second officer of the "Maplehurst" as to the range of visibility of that additional light since he avers that the box was painted white inside in order to better reflect said light.

Had a proper look-out been kept on the "Hackett" that emergency light would have been seen at least half a mile away, and timely enough for any action needed.

The "Maplehurst" failed in meeting literally and technically the requirements of Article 3; but was it a contributory cause of the collision?

Owing to the stupidity of the mate, Portelance, in maintaining his course and speed, and his avowed object to cross the bow of what he thought to be a sailing vessel, and his admitted lack of attention to notice the green light of the "Brookdale" till he was but a short distance from it, it is doubtful if a pro

perly constructed supplementary light on the "Maplehurst" would have been noticed by him.

In this instance the Court does opine that the lack of a properly constructed supplementary light did not contribute to the collision.

On the other hand the "Maplehurst" came in contravention with Article 29.

The Court must remark that on none of the four vessels concerned in this casualty was there a proper look-out kept. Article 29.

Also the pilot of the "Maplehurst" exhibited indifference in not noting whether his lights were burning bright.

The mate, R. Leonard, was not keeping his watch in the proper place where he could control the steering and see that the orders of the pilot were carried out, which it was his duty to do.

It also appears to the Court that the master, K. La Rush, was very indifferent as to whether the tug, or his tow, the "Brookdale" were seriously damaged or not; but was satisfied with a casual report from the "Brookdale" and no information from the "Hackett."

Section 920 of the Canadian Shipping Act requires the master of a vessel to make proper and necessary inquiries as to the extent of damage sustained in the course of a collision.

Finding

The Court having carefully reviewed and weighed the evidence adduced, finds, for the reasons given in the report, that the mate, Ovilon Portelance, of the tug "Margaret Hackett" is solely to blame for the collision, and, though he was not required to carry a certificate as mate of a tug, the Court finding him unfit to hold the certificate which he has, hereby cancels such certificate as Master of a Tug Boat No. 7584.

The master, William Allison, is exonerated from blame for this collision; but reflection is cast on his judgment for sailing his vessel until she sank in deep water instead of choosing a shallower spot.

Barges "Brookdale" and "Gladys H" are exonerated from blame; but are advised to keep better look-outs.

The "Maplehurst" is exonerated from blame for the collision; but the master, Kenneth La Rush, is found in default for not carrying properly constructed lights in accordance with Article 3 of the International Rules of the Road, and is therefore severely reprimanded.

He is also censured for not making more enquiries into the condition of his barge and the tug "Margaret Hackett." Had there been any loss of life the court would have held Captain La Rush criminally responsible. Fortunately such did not occur; but only the sinking of the tug, which could not be prevented, hence a censure only is passed and a caution given.

Pilot J. H. Raymond is cautioned to bear in mind that it is essential for him and all pilots to ascertain for themselves the condition of the navigational lights of the vessel they are piloting, also of the tow, if any.

The mate of the "Maplehurst," Roderick Leonard, is cautioned to keep his watch on the bridge and to constantly bear in mind his responsibilities as an officer.

The Court recommends to all concerned a stricter supervision and examination of aids to navigation and their equipment.

Read in open court at Ottawa, this 11th day of August, 1920.
Signed, L. A. Demers, Dominion Wreck Commissioner.

Concurred in by

Signed, Charles Lapierre, C. J. Stuart, Assessors.

GOSSIP FROM B.C. COAST

(Continued from page 209)

be disposed of as so much junk, as the cost of outfitting them for the commercial carrying trade would probably be excessive. The Rainbow has a length of 300 feet and a 43.9 foot beam, with displacement of 3,400 tons. She was built in 1891 and during the war was stationed at Esquimalt.

J. W. Spencer, one of the organizers of the Victoria Shipowners, Ltd., has resigned the presidency, and has been succeeded by Clarence Hoard, managing director of the Bainbridge Lumber Company. F. B. Pemberton, a director of the company, has also resigned. The company, supported by federal loans and public subscriptions, is building wooden lumber-carrying barquentines at Victoria.

R. B. Teakle, general manager of the Canadian Government Mercantile Marine, has announced the establishment of a trade route from Vancouver and Victoria to the Far East, including calls at Shanghai, Hongkong, Singapore, Colombo, Calcutta and Rangoon. It is expected that the first boat will be dispatched from Vancouver early in February. At least one ship a month will be placed on the run.

The Canadian Government is now inviting tenders for the purchase of the two submarines hastily acquired during the early days of the war from the Chilean Government to defend the shores of British Columbia from Admiral Von Spee's cruiser fleet and other German commerce raiders. The vessels are now lying at Halifax, although they made their headquarters at Esquimalt during the war and made several cruises down the Pacific coast. It was stated at the time that the presence of the underwater craft was the principal reason why the German war vessels did not attack British Columbia ports in the fall of 1914. The two submarines, both of which are about 145 feet in length with surfare displacement of about 310 tons, Construction and Dry Dock Company, Seattle, under contract with the Electric Boat Company, of New Jersey, to the order of the Chilean Government. They were known first as the Iquique and Atofogasta. When taken over by the Canadian Government they were re-named the C.C. 1 and C.C. 2.

Captain John Thompson, one of the pioneer pilots of British Columbia, died at his home in Victoria recently at the age of 69 years. He was in the pilotage service in British Columbia for forty-two years. On his retirement he was succeeded by Pilot W. H. Whiteley.

William Houston, for twenty-five years superintendent of the Victoria Machinery Depot, has retired from active services with the firm and has been succeeded by E. Redpath.

BOOK REVIEWS

The McGraw Hill Book Company Inc. 239 West 39th Street, New York, have just issued four new publications bearing on practical electricity. These books cover a very wide field, and will be found of great assistance to those interested in the different lines. The books are by well-known authors, and provide a welcome addition to the literature of the electrical science. They are "Armature Winding and Motor Repair," by Braymer, which has been very well received, the first edition being sold out in less than one month. The second is a new and revised edition of Croft's Wiring for Light and Power. It contains all the rules for wiring contained in the National Code of U.S. "Direct Current Motor and Generator Troubles," by Gandy and Schacht, tells all about tracing, preventing and remedying the troubles that the direct current machine is heir to. The last one is Lauer and Brown's "Radio Engineering Principles," which is an authoritative work on the developments in radio made during the war. It is supported by the signed recommendation of the Chief Signal Officer of the U.S. army, Major-General Squier. These four volumes cover a very wide field, and should be welcomed by the electrical profession in general.

Bounty for Iron Industry.—The Hon. William Sloane, Minister of Mines for the Province of British Columbia, speaking about the possibility of an iron smelting industry in the Pacific Coast Province, pointed out that the present bounty offered by the Provincial Government would amount on a 300-ton plan to something like $1,000,000. He stated that Mr. Fleming, of the Canadian Collieries (Dunsmuir), was looking into the situation, as their company thought of entering into the industry. As to the claim that there would be no market for the product, Mr. Sloane thought there would be no difficulty on that score, as the Pacific Coast could be supplied at prices beyond the competition of eastern furnaces. In any case, he thought the Federal Government could be induced to build extensive car shops for the National Railways at one of the western terminals, which would absorb a large percentage of the output of a 300-ton furnace.

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Marine News From Every Source

Montreal.—The steamer "Alexandrian" sailed from Montreal bound for Dantzic, thus inaugurating a new service from Canada to Germany.

Halifax.—A fleet of four trawlers and twenty-four drifters, a portion of the 100 or more of these vessels that were sold by the Canadian Government, sailed for Scotland recently. They will call at the Azores on their way across for coal. They will be employed in the fishing service round the British coasts.

Brockville.—The raising of the sunken steamer, Keystorm, sunk in the storm of 1913, near Sister Lighthouse, is getting near the final stages. Captain Leslie, of Kingston, who is engaged on the work, is confident that the feat can be accomplished despite the numerous failures that have taken place.

Alpena, Mich.—Two barges lost, and the steamer Charles Bradley seriously damaged, was the result of a recent storm on Lake Huron. The Bradley, which was towing two barges, the Mystic and the Blodgett, was forced to send out wireless calls for assistance, when her tow collided with her and smashed in her stern. The steamer Huron stood by the Bradley all night, and in the morning took off the crews of the barges, which were filling rapidly.

Welland.—The stern section of the steamer "Canadian Squatter" was launched from the yard of the British American Shipbuilding Company recently. After both sections have been launched, they will be towed to Montreal where they will be joined together by the Canadian Vickers Co. The "Canadian Squatter" will, when completed, be 320 feet long, 43 feet, 10 inches beam, and 25 feet deep. She will have a deadweight capacity of 4,350 tons, and a speed of 11 knots.

Montreal. — Considerable trouble is being experienced by masters of British vessels coming to Canadian and United States ports by the desertion of their crews. The men desert in order to ship in vessels under American and Canadian registry and to get the higher wages paid by them. In order to stop this epidemic of desertion, all cases will be prosecuted and the full allowable punishment will be sought for. In two days there were twenty desertions in one port alone.

New Service Projected.—As a result of the deliberations of the West Indies Conference, a new steamship service will be inaugurated early in 1921, between Canada and the West Indies. The service will be carried on by two of the new steamers building for the Canadian Government, and will provide sailings from Halifax and St. John to Bermuda, Bahamas, British Honduras and return. The steamers will carry about 50,000 tons cargo and accommodate about 25 passengers.

Another Shipyard Failure. — The Three Rivers Shipyard, a branch of the National Shipbuilding Co., of Wilmington, Delaware, U.S.A., located at Three Rivers, P. Q., has gone into liquidation. The company built a fleet of ten wooden steamers for the French Government. A liquidator has been appointed to wind up the affairs of the company.

Halifax.—The strike at the Halifax Shipyards, which commenced June 1st, has at last been settled. The plumbers, coppersmiths, and pipe fitters, the three unions which had hung out after the other men accepted the company's award of five cents per hour increase, have decided to return to work. The decision was practically unanimous, only one member dissenting out of one hundred.

Barge Building at Victoria.—A considerable portion of the plant of the Foundation Co. of British Columbia, located at Ellice Point, has been purchased by Capt. A. Berquist, a well-known tug operator. The plant includes two of the gantry cranes, four shipbuilding ways, and shipbuilding plants and buildings. The amount involved was about $25,000. It is Captain Berquist's intention to construct tugs and barges at the plant, at which he built the tug Berquist in pre-war days.

To Boom Toronto Port—A meeting was held at the City Hall recently, Mr. Hollinrake, of the C.M.A., being in the chair, when it was decided to request the City Council, Board of Trade, Harbor Commission, Canadian Manufacturers' Association, Rotary Club and Kiwanis Club, and the District Labor Council to appoint representatives on a committee to procure evidence to present to the next meeting of the International Joint Committee on its next meeting here. The meeting was under the auspices of the Canadian Deep Waterways Association.

Starting in Vancouver.—The Britannia Wire Rope Co., is getting in shape to operate at their plant on Granville Island, B.C. The machinery for most of th plant is now on the way from Englanc C. H. Gill is the British director, an Robert Gibson, managing director.

To Give Bond.—After his appoint ment as assignee for the Dominio Shipbuilding Company Mr. Osler Wad said there would be no statement of as sets and liabilities for another thre weeks. Mr. Wade gave a security bon of $200,000 in a security company. I is hoped that the wages due the em ployees will be paid in a few days.

Want To Export Coal. — The chair man of the Dominion Railway Commis sion is receiving many applications fo permission to export coal. There ha been an order against the export of an coal from August 1st, and the applicant claim that they had the contracts mad and vessels chartered to carry the co before the order came out. The therefore, claim that they should be a lowed to export those orders.

Alberta's Coal Export Increased. – The output of the Alberta mines fc the six months ending July 31st wa 3,043,940 tons, as compared with 2,068 907 tons for the same period last yea There has been more coal marketed du ing the six months period than in an corresponding period in the history c coal mining in Alberta. The exports tions for the six months show a 50 pe cent. increase.

The Canadian Vickers Company agai celebrated the launching of anothe Government steamer when the hull of th "Canadian Conqueror" was placed in th water recently. This is the ninth vess that this company has launched for th C. G. M. M. The keel for another Can adian Government boat was ready to b placed as soon as the Conqueror passe down the ways. Three vessels are sti under construction for the Government.

Motor Ship in Montreal.—The 8,75 ton deadweight motor ship "Oregon has arrived in the St. Lawrence an will load at Montreal for River Plat ports. She was built at Copenhagen i 1916, and is owned by the Scandinavia American line. She has Diesel engine of 2,600 h.p. and a speed of 10½ knot She is commanded by Capt. Julius Lis ner, and carries a crew of 35 men a told. The auxiliary machinery is ele trically driven. Her usual port is Ne York, but labor troubles made her vis Montreal this voyage.

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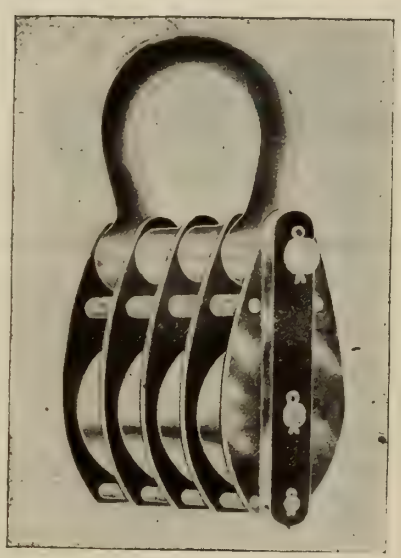

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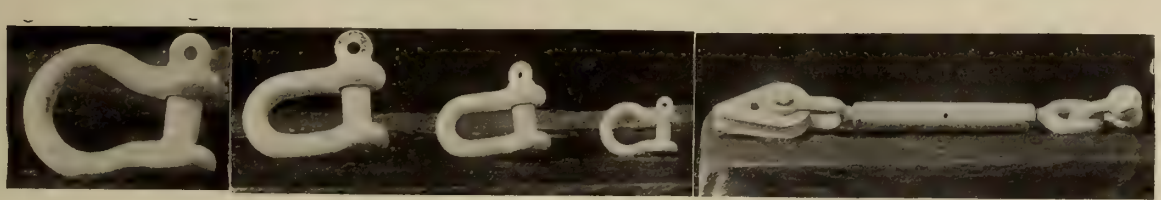

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NOTICE TO MARINERS

UNITED STATES OF AMERICA

(69) Lake Huron—Fort Gratiot Light-station—Auxiliary Fog Signal.

Position. — On mainland, north entrance to St. Clair river.

Latitude N. 43° 00′ 22″ Longitude W. 82° 25′ 21″.

Auxiliary fog signal.—An auxiliary fog signal has been placed in commission at Fort Gratiot lightstation. When foggy in river but clear on lake diaphone will sound a blast of 5 seconds duration every 60 seconds. No change in steam whistle, which will sound same characteristic as heretofore, when foggy on lake.

Authority.—U.S. Department of Commerce N. to M, No. 20 of 1920.

Publication.—U.S. Lake Survey Bulletin No. 28, page 294.

BRITISH COLUMBIA

(67) Haro Strait and Boundary Pass—Survey Steamer Engaged in the Survey of Currents to be Avoided.

It is the purpose of the Government of the Dominion of Canada to examine, during the present season, the currents in Haro Strait and Boundary Pass. For this purpose the C.G.S. "Armentieres" will be anchored at different points between Discovery Island and East Point.

The steamer will display the usual day and night signals for a vessel unable to manoeuvre, and in foggy weather will sound one long blast of the whistle followed by two short blasts.

Mariners and masters of coasting vessels when in these waters are requested to keep a look out for the "Armentieres" and give her a safe berth in passing.

Authority.—Report from Department of the Naval Service, Ottawa.

Admiralty charts.—Nos. 2840, 2689 2531 and 1917.

Publication.—British Columbia Pilot, Vol. 1, 1913, page 154.

Departmental File.—No. 32919.

A. JOHNSON,
Deputy Minister.

Department of Marine and Fisheries,
Ottawa, Canada, 17th May, 1920

No. 32 of 1920
(Atlantic No. 14.)

PRINCE EDWARD ISLAND

(71) South Coast — Northumberland Strait—Tryon Shoal—Whistle Buoy Replaced by Gas and Bell Buoy

Position.—Off the south extremity of Tryon shoals. Latitude N. 46° 9′ 30″. Longitude W. 63° 31′ 45″.

Character.—Occulting white light.

Description.—Steel cylindrical.

Color.—Red.

Depth.—36 feet.

Authority.—Report from agent, Department of Marine, Charlottetown.

Admiralty Charts.—Nos. 2034, 1651, 2516 and 2666.

Publication.—St. Lawrence Pilot, Vol. 2, 1916, page 262.

Canadian List of Lights and Fog Signals, 1920.—No. 731.

Departmental File.—No. 33958.

QUEBEC

(77) River St. Lawrence—Ship Chann Between Quebec and Montreal— Gentilly Front Range Light Carried Away by the Ice — Temporary Light

The pier supporting the front light c the Gentilly range lights was carrie away by the ice, and, until further n tice, a temporary light has been place on a platform on piles on the same si

Authority.—Report from agent, De partment of Marine, Montreal.

Canadian Naval Charts.—Nos. 13 an 23.

Admiralty Charts.—Nos. 2780, 2830 and 797.

Publication.—St. Lawrence Pilot abov Quebec, 1912, page 49.

Canadian List of Lights and Fo Signals, 1920.—No. 1298.2.

Departmental File.—No. 21298.2R.

A. JOHNSTON,
Deputy Ministe

Department of Marine and Fisherie Ottawa, Canada, 26th May, 1920.

Pilots, masters or other interested ar earnestly requested to send informatio of dangers, changes in aids to naviga tion, notice of new shoals or channel errors in publications, or any other fact affecting the navigation voucher of Can adian waters to the Chief Engineer, D partment of Marine and Fisheries, Ot tawa, Canada. Such communication can be mailed free of Canadian postage

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This Safe Working Load is an exclusive feature of Parish Blocks and has been made possible only after an exhaustive series of tests and experiments which occupied the engineers in our employ the greater part of a year. The result of this investigation and research, however, has been the production of a scientifically designed tackle block built for a definite working load, and stamped with this load in clear, distinct figures. Every Parish Safe Load Tackle Block will carry much more than its rated capacity, but the tonnage marked on it gives a good margin within which there is absolute safety.

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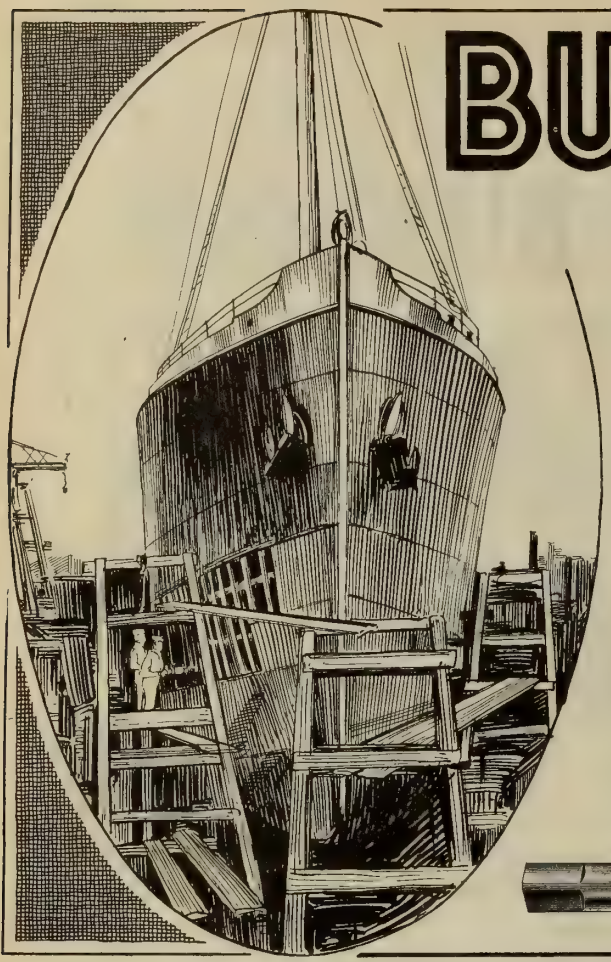

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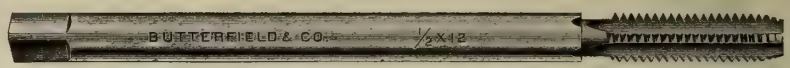

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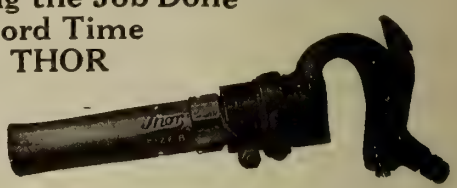

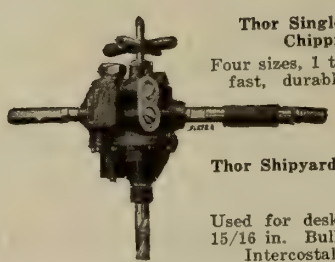

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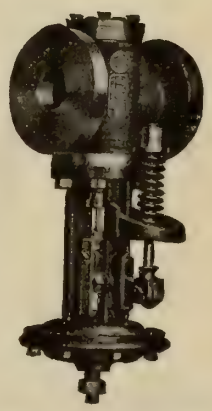

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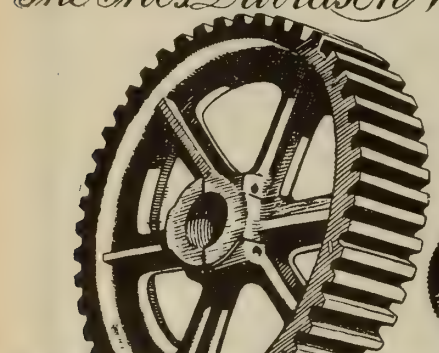

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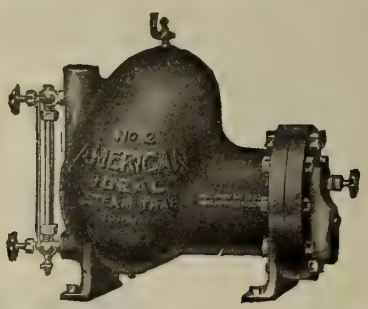

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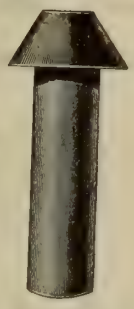

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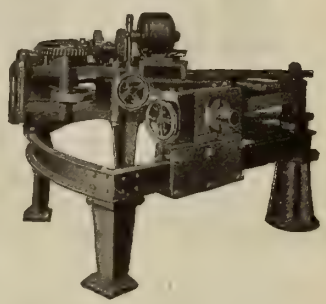

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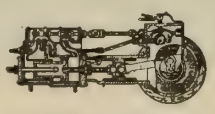

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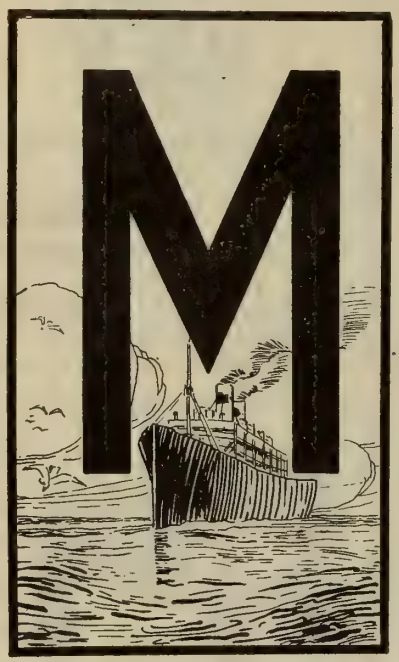

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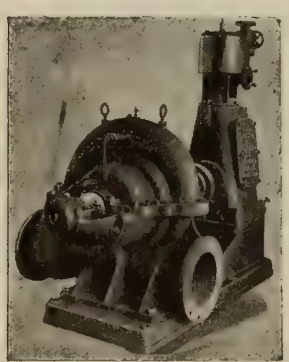
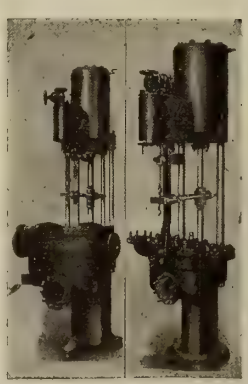
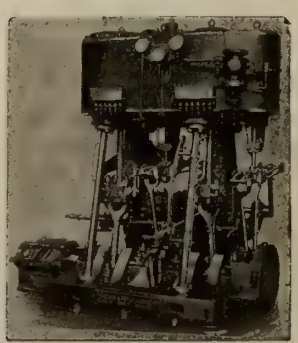


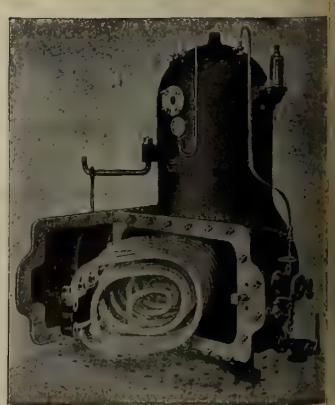
Rees RoTURBo Pumping Unit



Vertical Marine Pumps



Compound Marine Engines.



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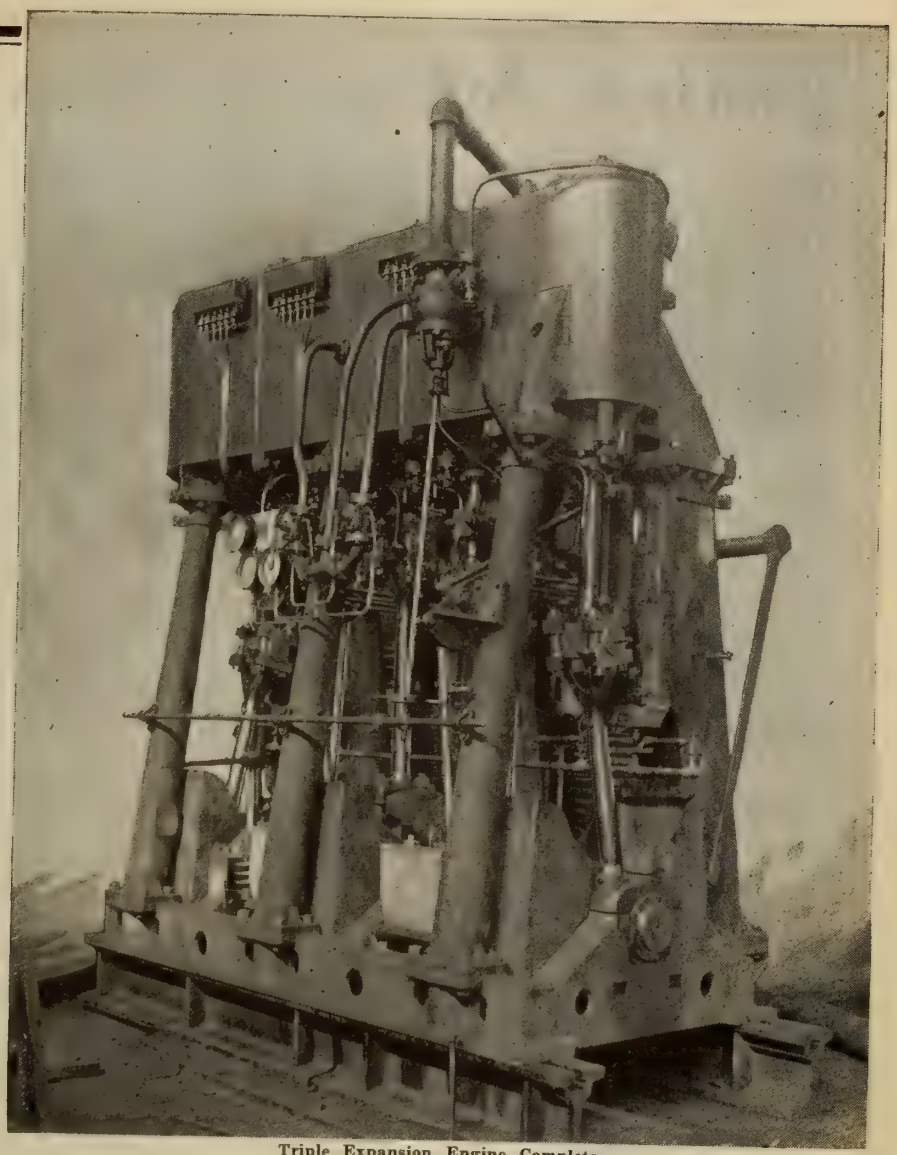

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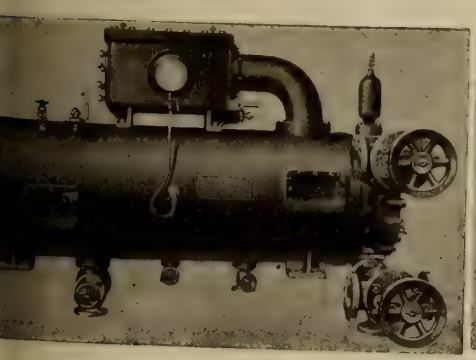
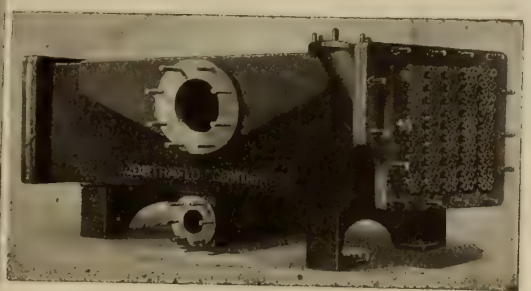


"Contraflo" Compensator Feed Water Heater



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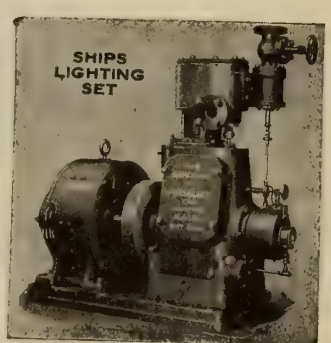
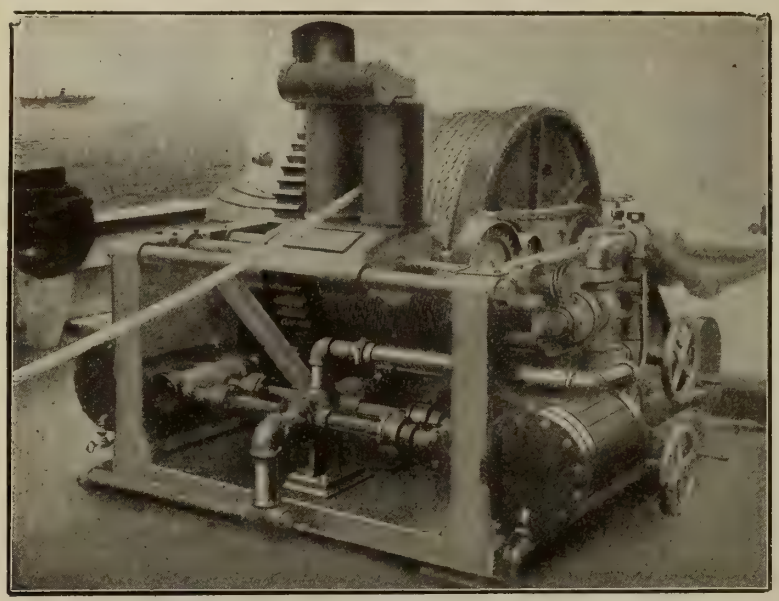


Corbet Automatic Towing Machines



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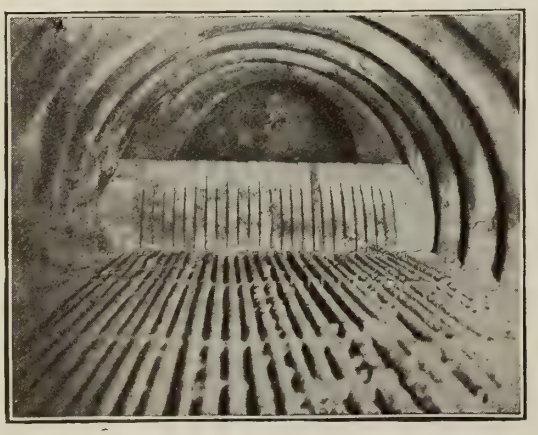

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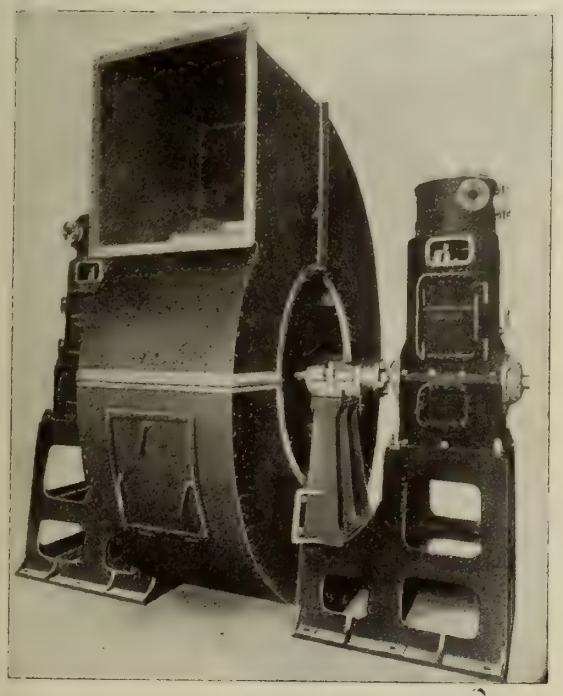

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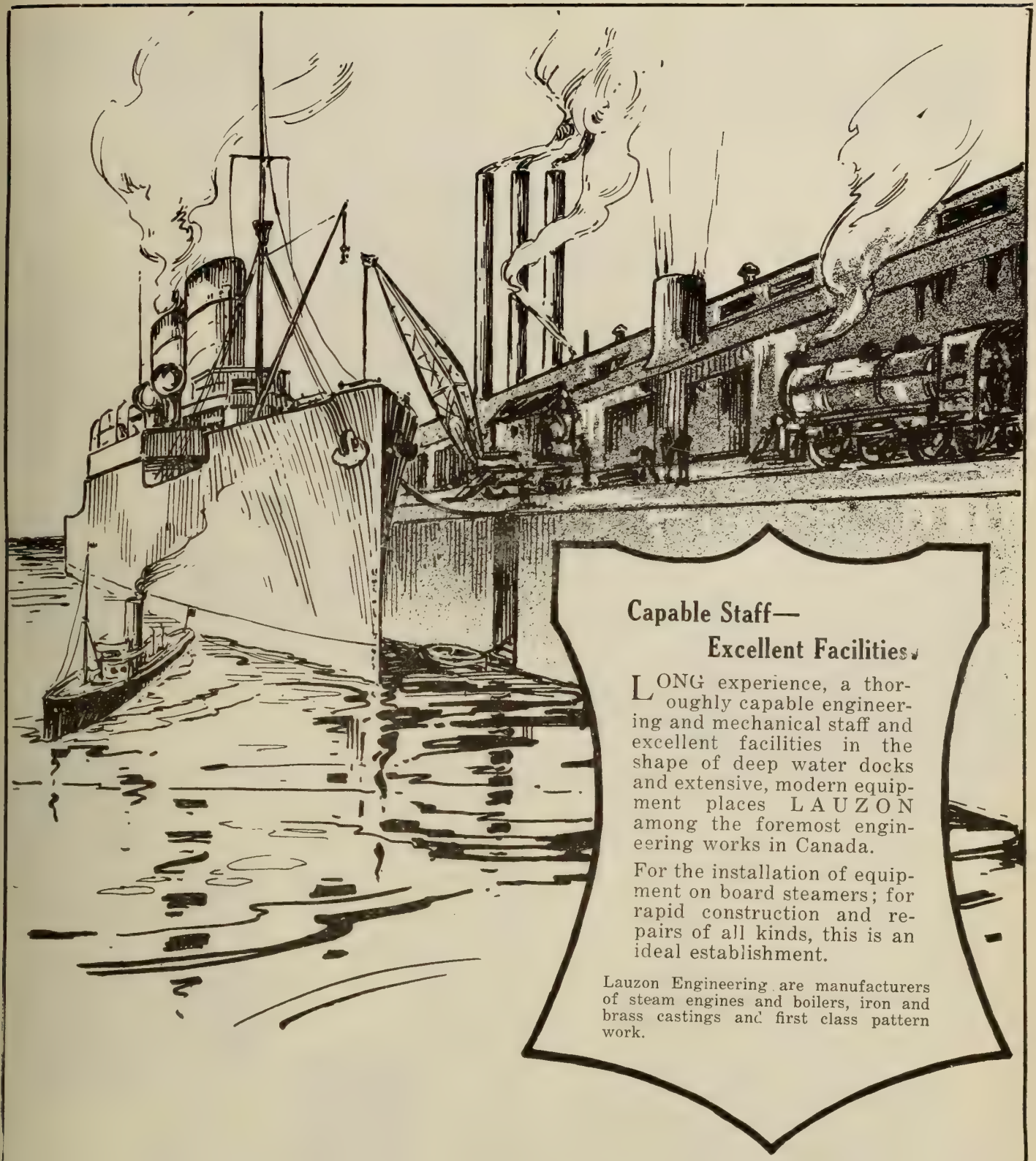

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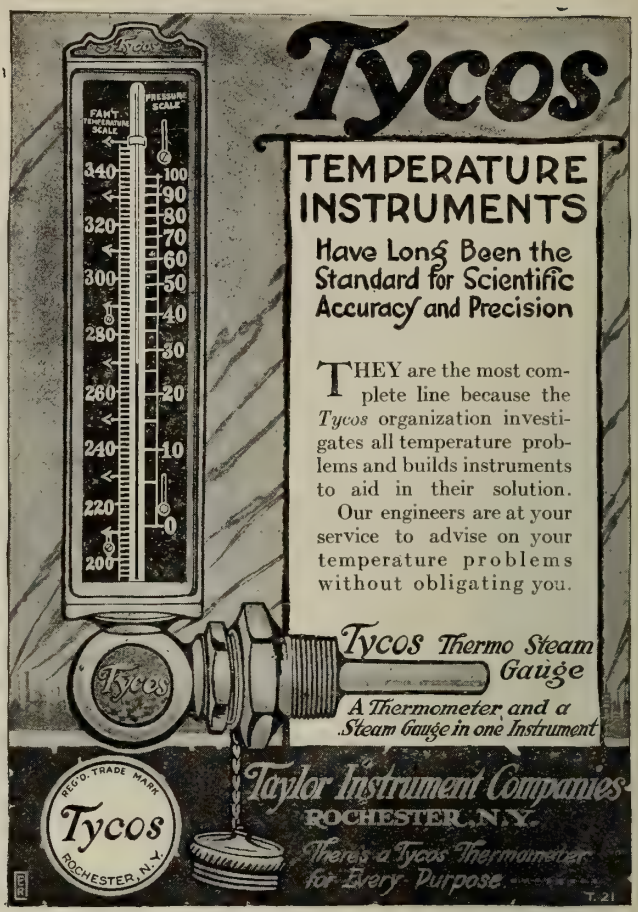
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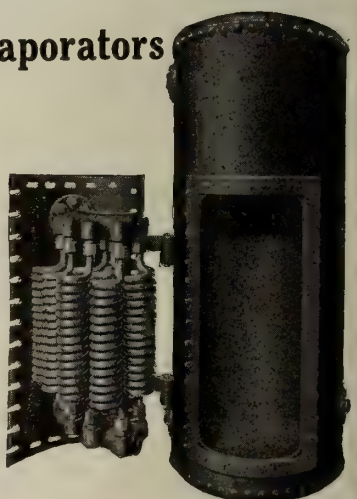

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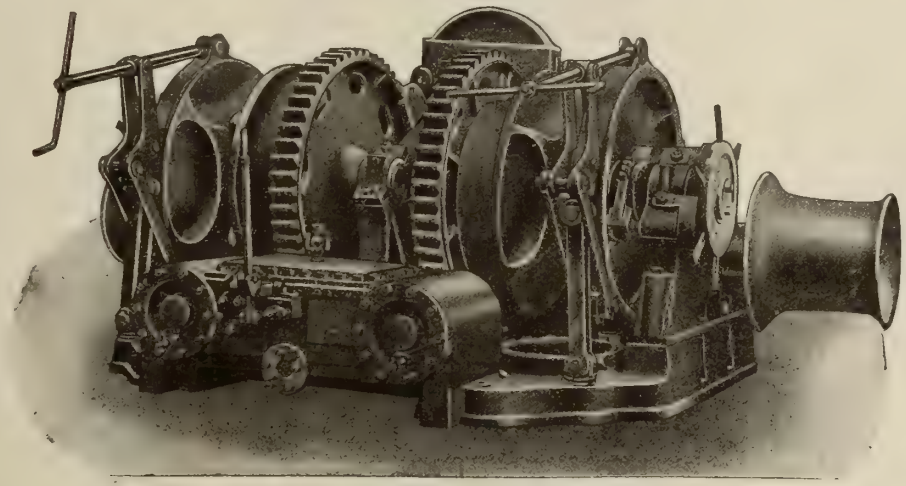

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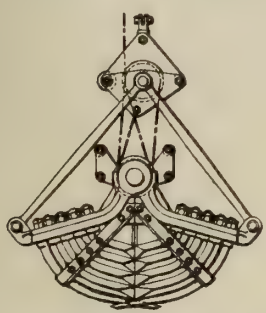

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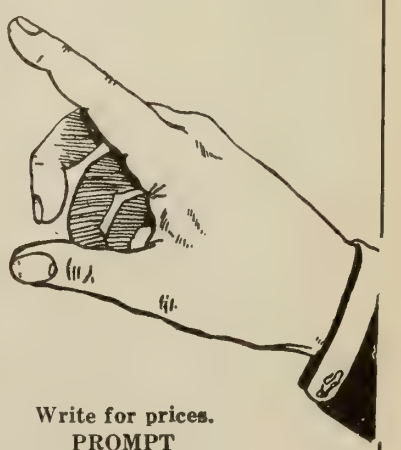

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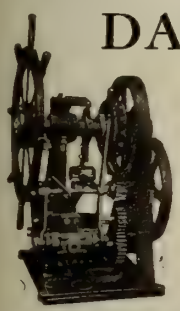

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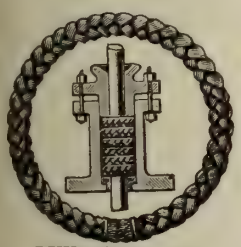

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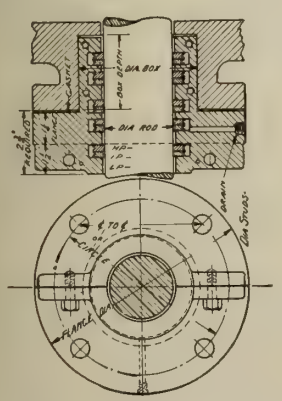

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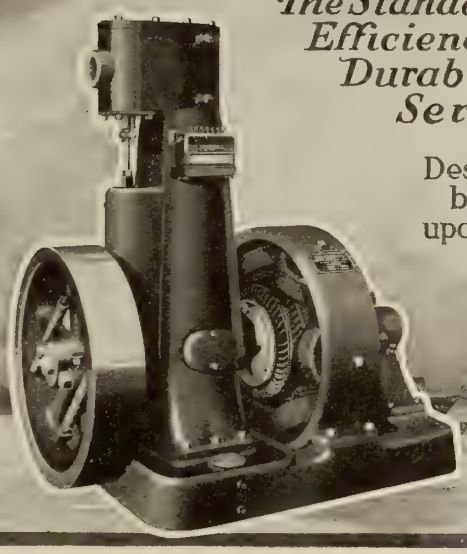

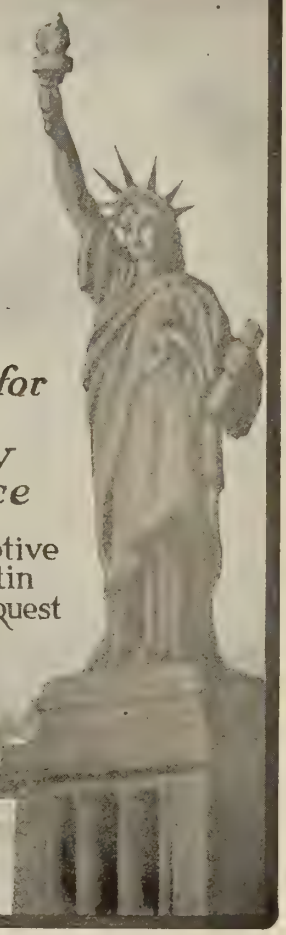

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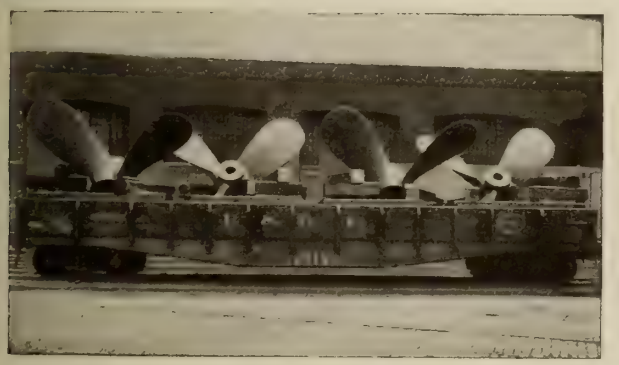

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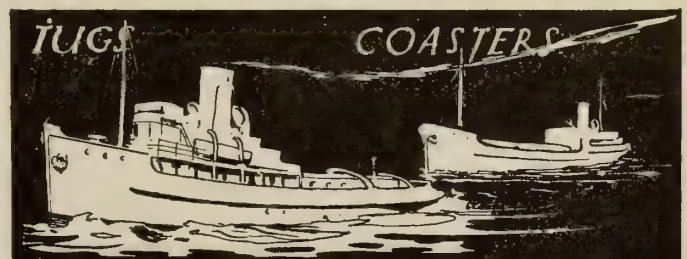

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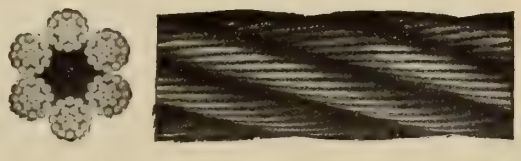

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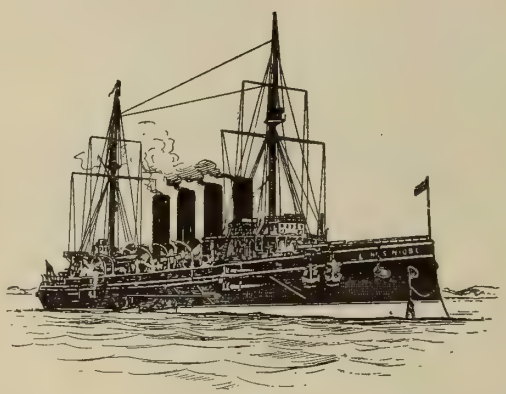

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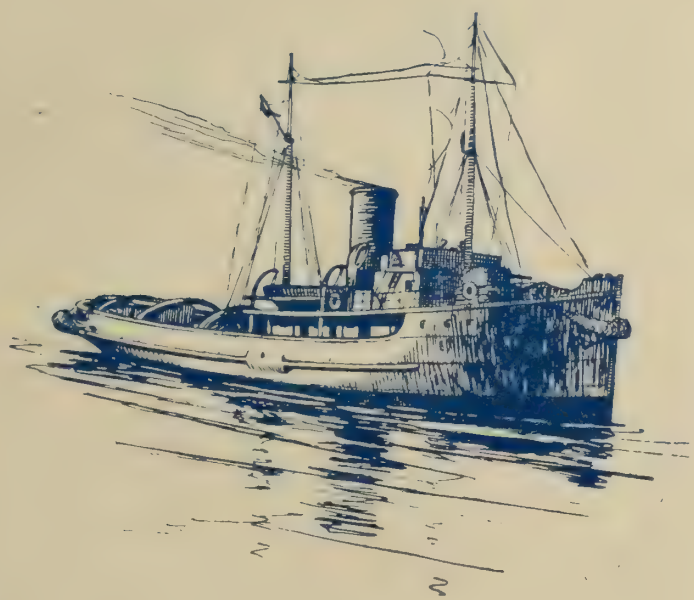

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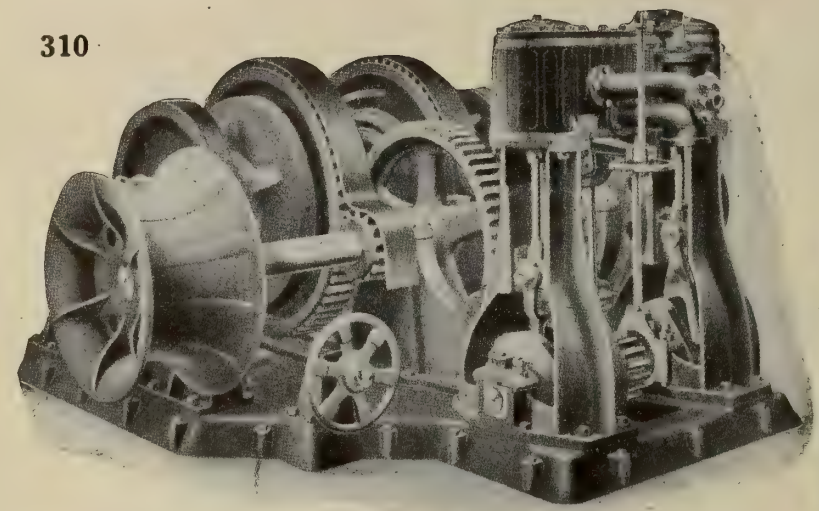

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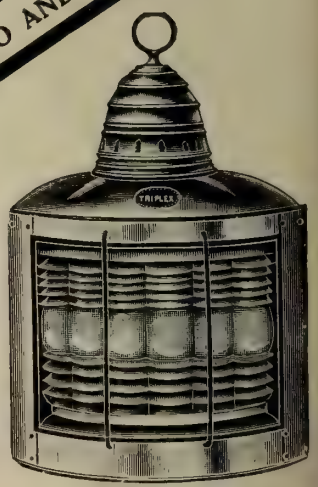

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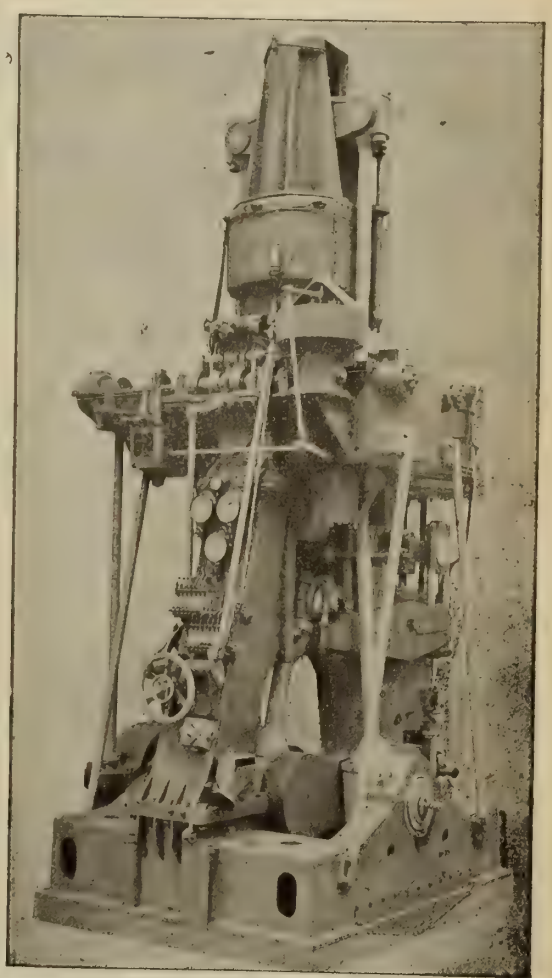

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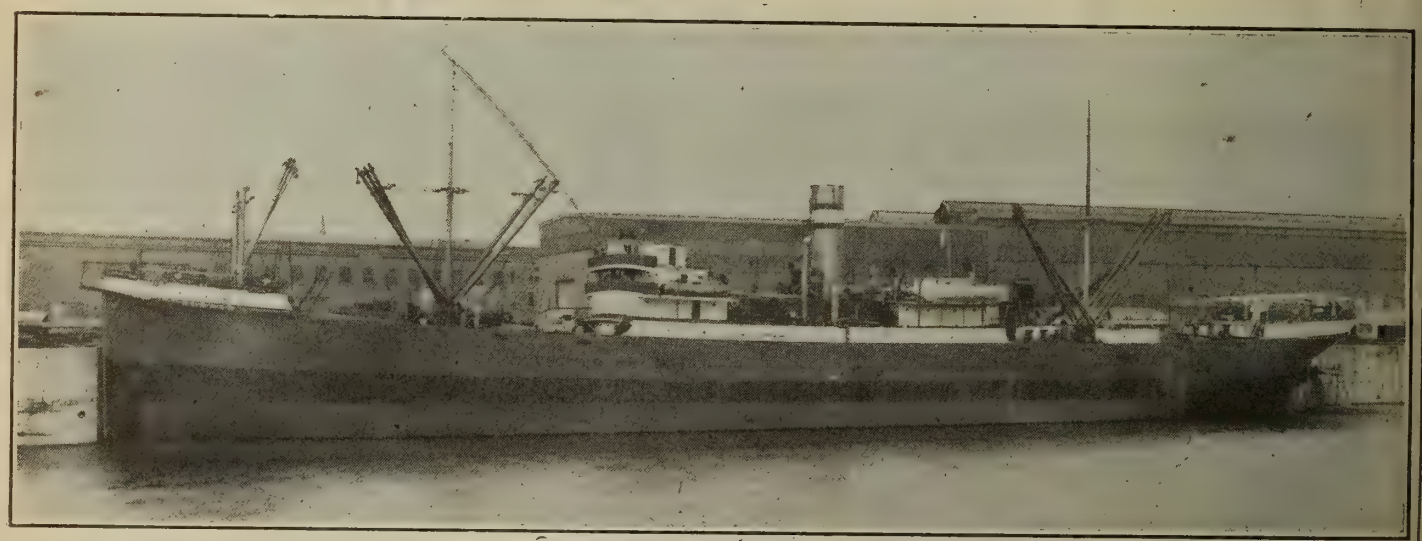

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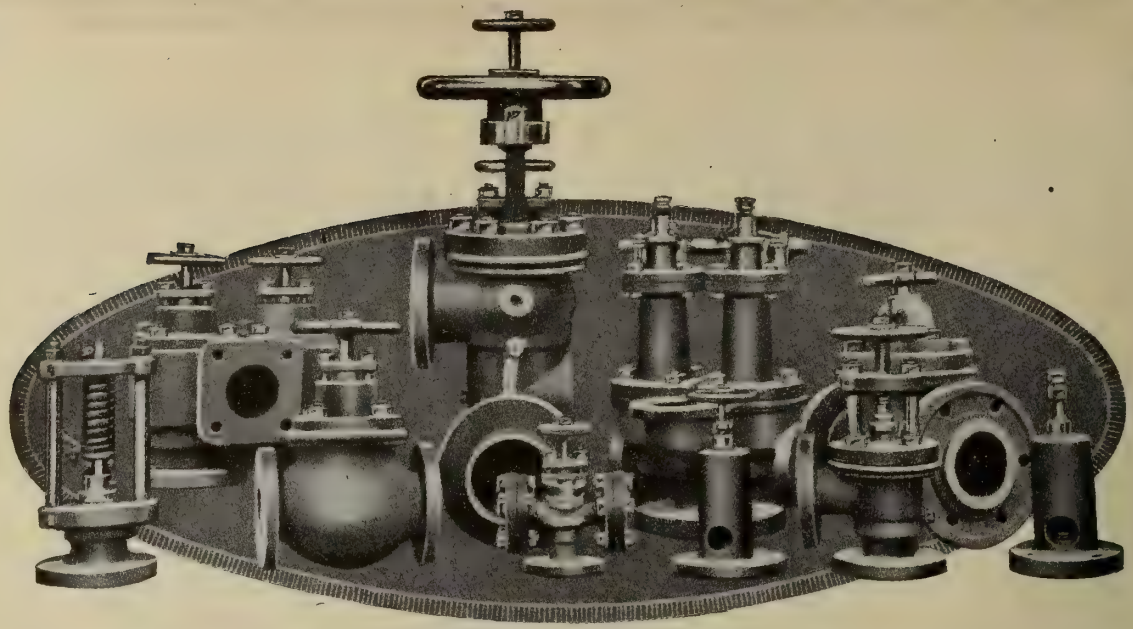

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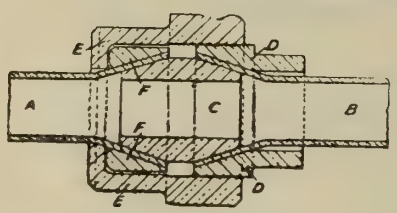

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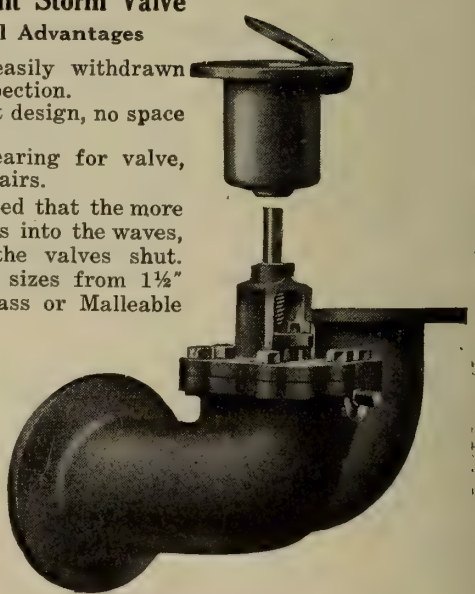

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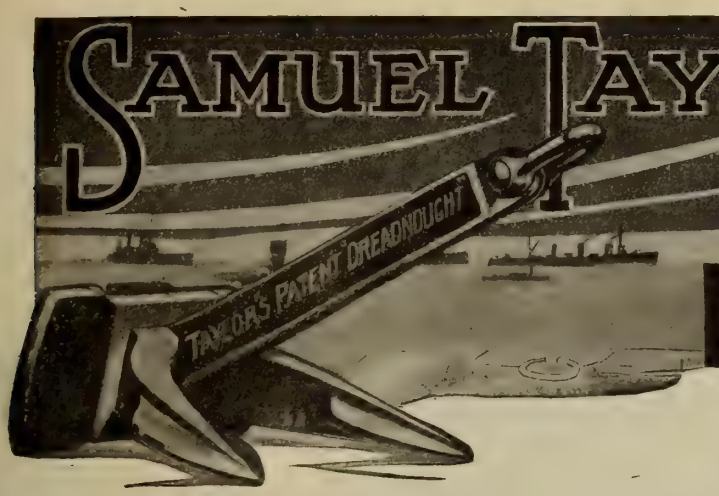

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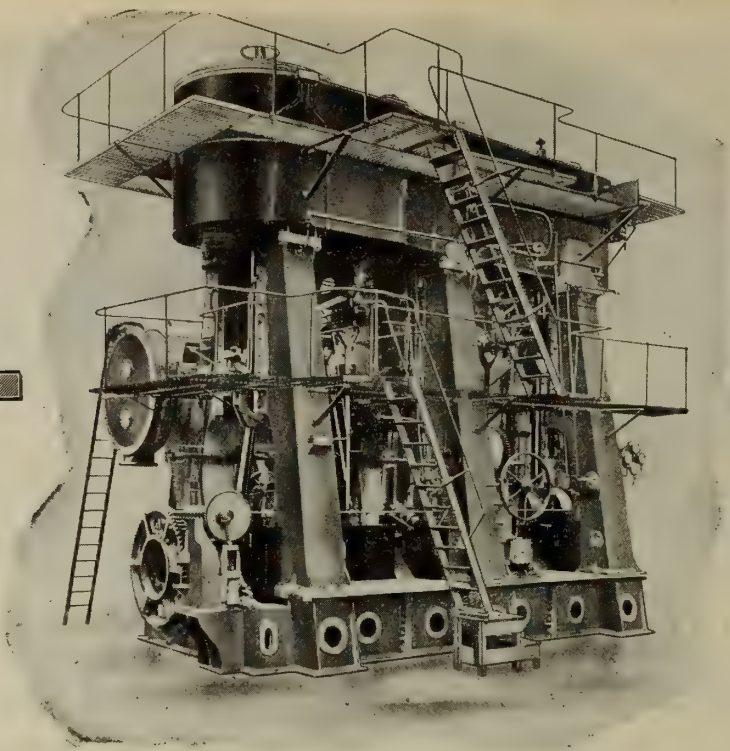

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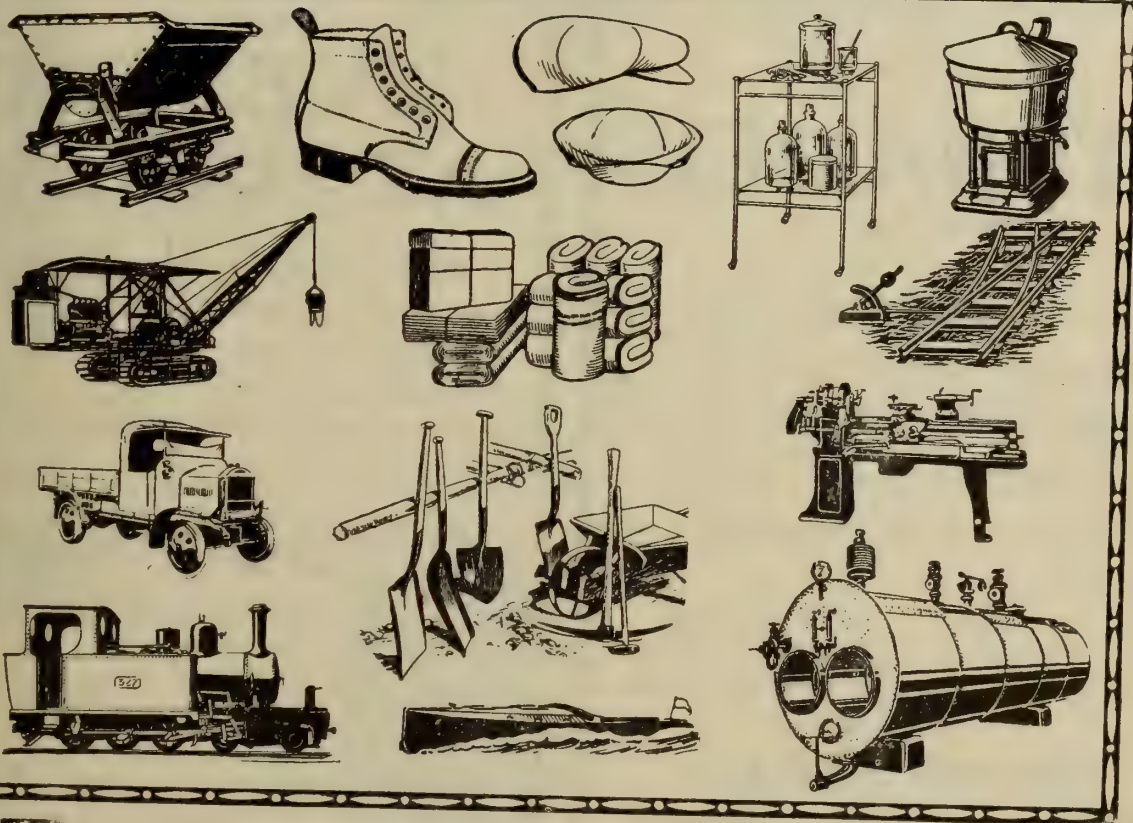

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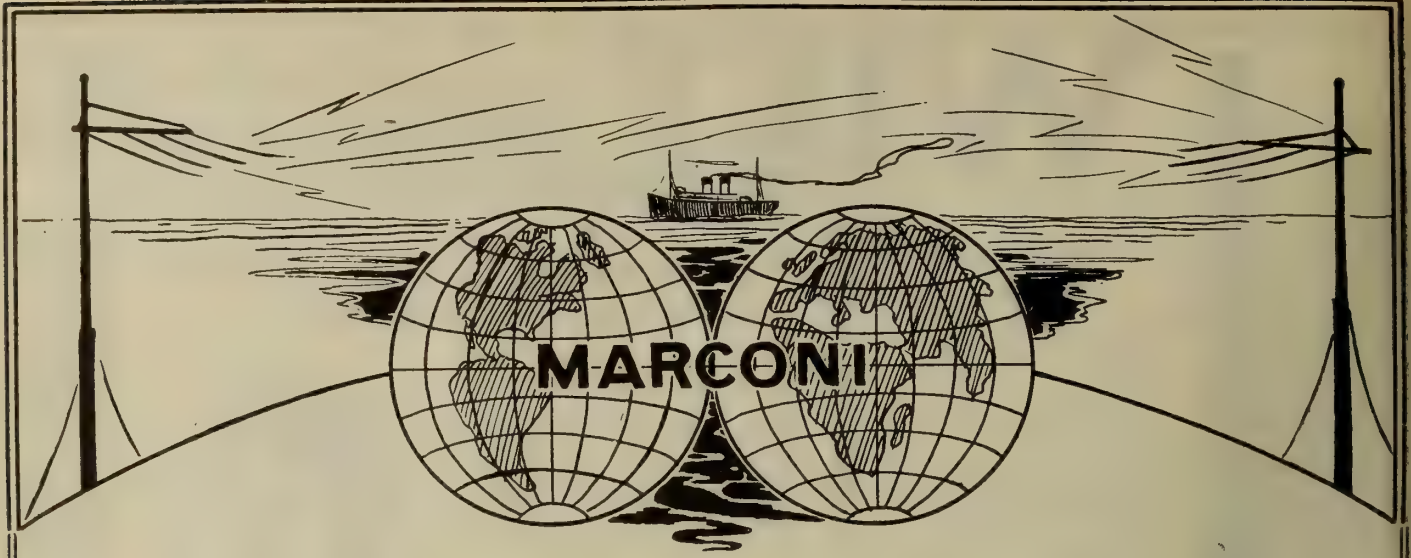

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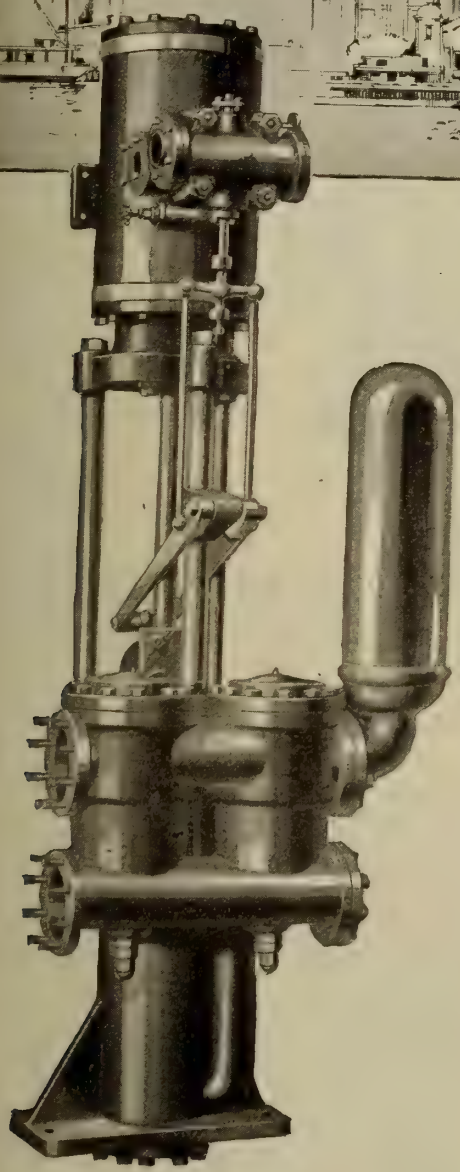

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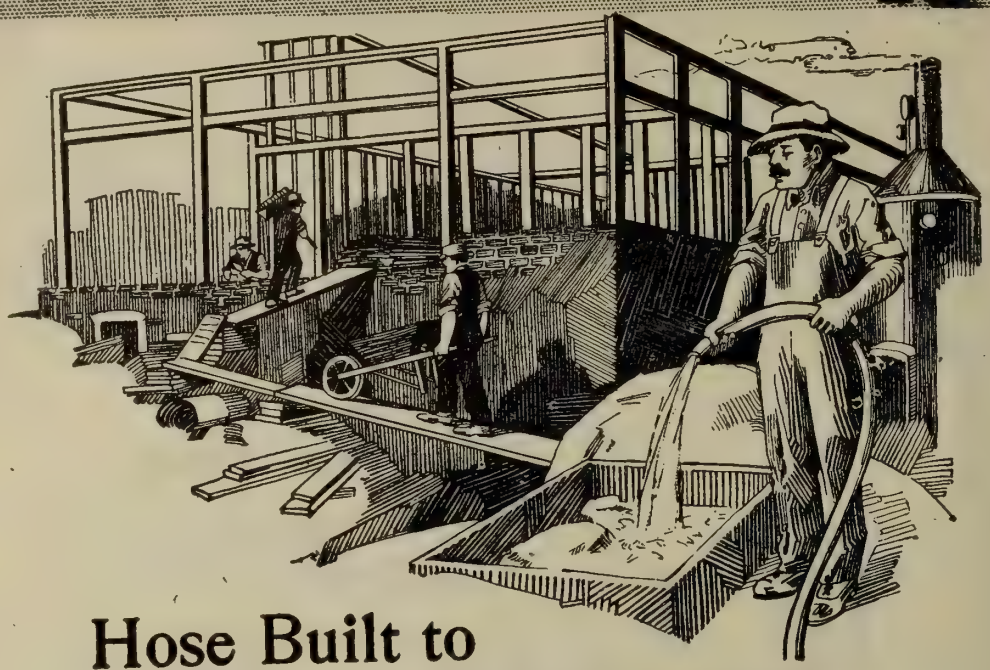

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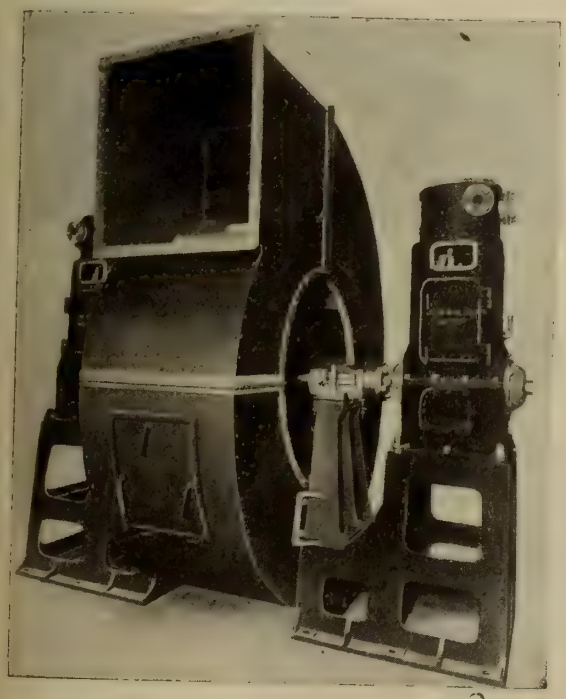

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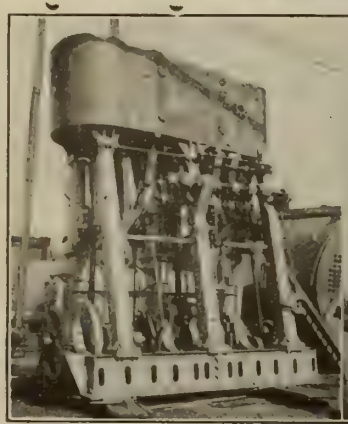

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MARINE ENGINEERING
and
Canadian Merchant Service Guild Review

Vol. X. SEPTEMBER, 1920 No. 9

The Electric Propulsion of Ships

A Paper Read Before the Institute of Marine Engineers, London, in Which the Author Traces the Development of Electric Propulsion from Its Inception to the Present Day.

By CAPT. W. P. DURTNALL, R.A.F.

THE Chairman: We are about to hear a paper which appropriately follows those which have been read on the History of the Steamship and the Development of the Internal Combustion Engine. The author read a paper bearing on the subject he proposes to deal with about eleven years ago, and to-night he will indicate the progress made since then. There are many lantern slides, I understand, to be shown to us, and as we must close at nine the discussion will follow at our own premises, the date will be announced in the usual Notices which are printed in the monthly issues of our transactions.

In these days when almost every technically trained mind is turning from the anxious progress of our arms at sea, on land, and in the air, from the practical application of destructive engineering to the transfer of these arts to commerce, well balanced minds are well aware that on the work of progressive engineers will the welfare of empires rest.

Early in the days of the late tremendous war between scientifically trained and practised nations it rapidly became evident that the days of physical prowess of hardy seamen and soldiers was over and had really become a glorious past history in the annals of the world, and that they had been replaced by mechanical science much more conspicuously.

Indeed, if one reads right down through the known history of the civilized world, the work of the engineer is always pre-eminent; even from the pre-Christian days of "Hero" and "Archimedes," whose work is even to-day to be seen in many directions of engineering science in some of the very greatest industries, in the form of the steam turbine, the force pump, the air compressor, and a large number of mechanical apparatus, they indeed represented the blessings of the future generations and the rock bottom foundations of the great engineering industries of to-day.

Great as was the significance of these early engineering inventions, comparatively speaking, very little was accomplished, chiefly owing to the want of tools for the proper manufacture of the apparatus, and passing through the centuries we come to the period of 1543, when the Spanish sea captain, Blasco de Garay, succeeded in giving motion to paddle-wheels by means of steam. Various attempts have been made to use the propulsive force of a jet of water, and in 1661 a patent was granted to Thomas Toogood and James Hayes for a method of propelling ships by forcing out water through the bottom of the vessel, probably one of the very earliest attempts at jet propulsion, of which we have heard so much recently, owing to the fact that both prime-movers and pumps are to-day very much more efficient than at the early period.

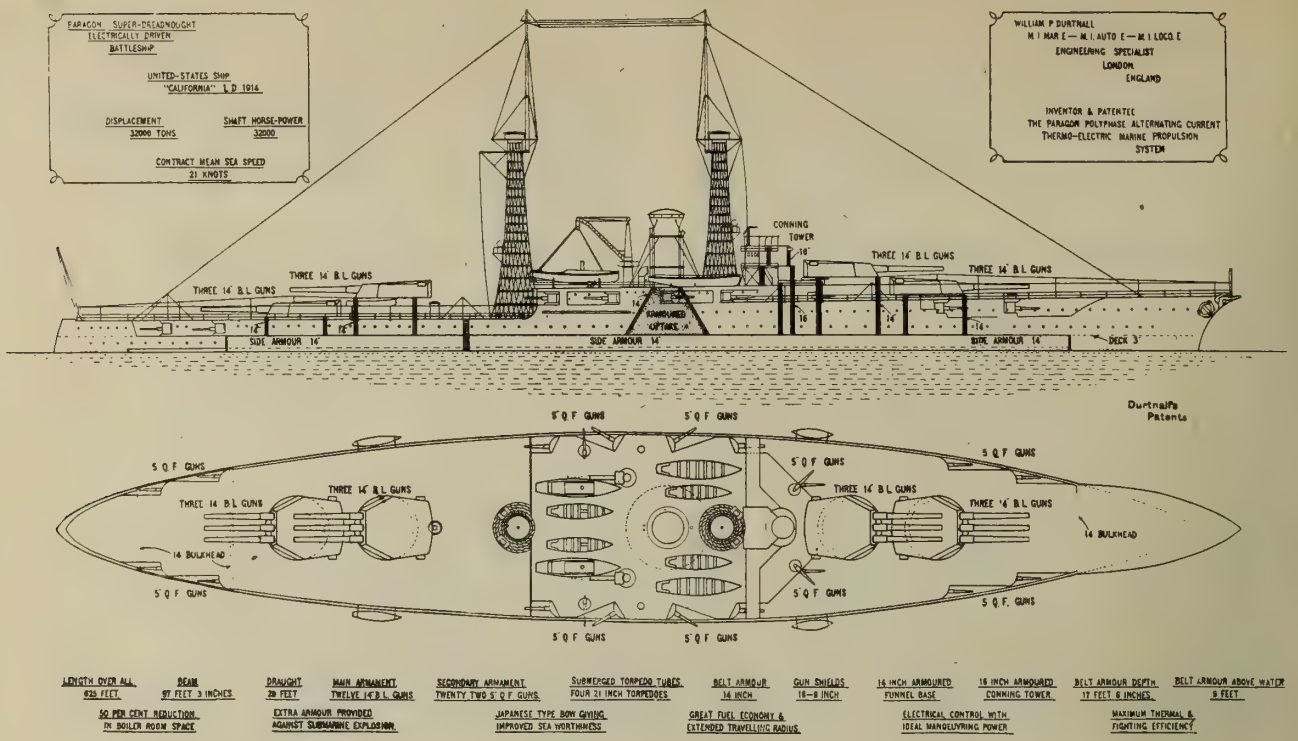
Feathering paddle-wheels were the subject of a patent in 1681 by Robert Hook, and much has been done in that line to increase the propulsive efficiency of this type of propeller, until it was put out of date by the application of the screw propeller with deeper immersion.

Screw propulsion was, however, practically introduced in the 19th century, about 1835, by a farmer, Francis P. Smith, of Hendon, Middlesex. In May, 1836, a model boat fitted with a wooden screw propeller was exhibited in operation on what is now known as the Welsh Harp Pond at Hendon, and was inspected by Sir John Barrow, Secretary to the Admiralty. The results were deemed so satisfactory that in the autumn of the same year a boat was built of six tons burden and fitted with engines of six horse power, driving a wooden screw propeller consisting of two turns. On November 1st, 1836, she was exhibited in operation on the Paddington Canal and continued to ply there until September, 1837, without a great deal of notice, as of course often happens with all really great inventions.

In February of that year, however, she became conspicuous by reason of an accident which occurred, about half the length of the propeller being broken away, and to the surprise of all, the boat immediately quickened her speed, a higher thrust was produced for the same horse-power, at the same time indicating that the continued thread was really unnecessary, and as is to-day seen in practice the part thread screw is the more efficient of the two. The sea-going qualities of the vessel were then demonstrated with great success, but before the Admiralty would give a decision they insisted that the screw propeller should be tried on a vessel of at least 200 tons, as it was stated that although it apparently operated with satisfaction on a small boat, it would perhaps not be suitable for a large vessel.

Considerable losses took place between the engine and the propeller owing to the installation of mechanical gearing being used to gear the propeller up, as the steam engine in those days was not far enough advanced in speed for direct-coupling in the most efficient manner possible. Mr. Smith, however, formed a company and built a further vessel named the "Archimedes," of 237 tons, at a cost of £10,000, and this was fitted with an 80 horsepower engine, and designed for 4 to 5 knots, which speed was about doubled on the trials; the vessel was thoroughly tried at sea and around the coast, resulting in the Admiralty deciding to adopt the screw propeller in the navy. Mr. Smith was afterwards joined by that famous engineer and inventor, Captain John Ericsson, who cleared out the inefficient gearing and directly coupled the engine to the propeller shaft, and increased the revolution speed of the engine suitable for the propeller, but who, after a most heroic attempt to interest people in this country, failed to do so, and crossed to America, ultimately to become the engineering hero of the American Civil War, when it will be remembered his famous steam driven "Monitor" successfully contested the rights of the "Merrimac," a fighting vessel which he built in 100 days in spite of all sorts of official expert opposition. A story of this great fight, and the tremendous engineering victory, and its effect on the navies of the world after it was over, is of great interest.

It should not be forgotten that every possible credit should be given to those early workers in mechanical marine transport who experienced great opposition from many quarters, they had not the advantages of our modern manufacturing machinery, they had to edu-



cate both shipbuilders and owners, who were not engineers but sailors, most of whom were opposed to new methods of propulsion, and demonstrated very little desire or ability to master the higher branches of either navigation or mechanical sea transport, they being quite satisfied with sails, and the tactics which had sufficed for Blake and Nelson, for Van Tromp and De Ruyter were good enough for their then successors.

Captain Ericsson, whilst in America, carried out much interesting work in the development of sea transport, and one of the greatest wonders of marine engineering was found in 1853 in the form of his famous ship "Ericsson"; indeed this vessel formed the boldest attempt which was made at sea for many years; she was operated by means of what was then known as the calorific principle, in substitution of steam. She was 250 feet long, 40 feet beam, and 31 feet deep, with a gross tonnage of 1,920, and a sea speed of 12 knots for a consumption of only six tons of coal per day.

This interesting vessel was practically propelled by a "hot air engine" and in my opinion Captain Ericsson was very near to the solution and discovery of the internal-combustion engine. I daresay there are people alive to-day who well remember the arrival of this strange but efficient vessel at Liverpool, being somewhat conspicuous by the absence of the usual funnels.

An interesting attempt to bring about improvements in the propulsion of ships was that which was carried out by the Admiralty many years ago on H.M.S. "Waterwitch." She was an iron-plated gunboat, 162 feet long, 32 feet beam and 9 feet 9 inches draught, with a displacement of 1,062 tons. She was propelled by means of two water jets placed about mid-ships, either "ahead" or "astern," including "steering," these jets for some reason were placed near the surface, in which position it was hardly likely that the highest propulsive efficiency could possibly have been expected.*

The water supply was created by means of a large rotary pump 14 feet diameter, driven by means of a horizontal three-cylinder vertical shaft engine, the cylinders being placed at 120 degrees angle, the suction being taken from an aperture let in the bottom of the vessel, no attempt apparently being made to utilize the bow pressure for suction head for the pump.

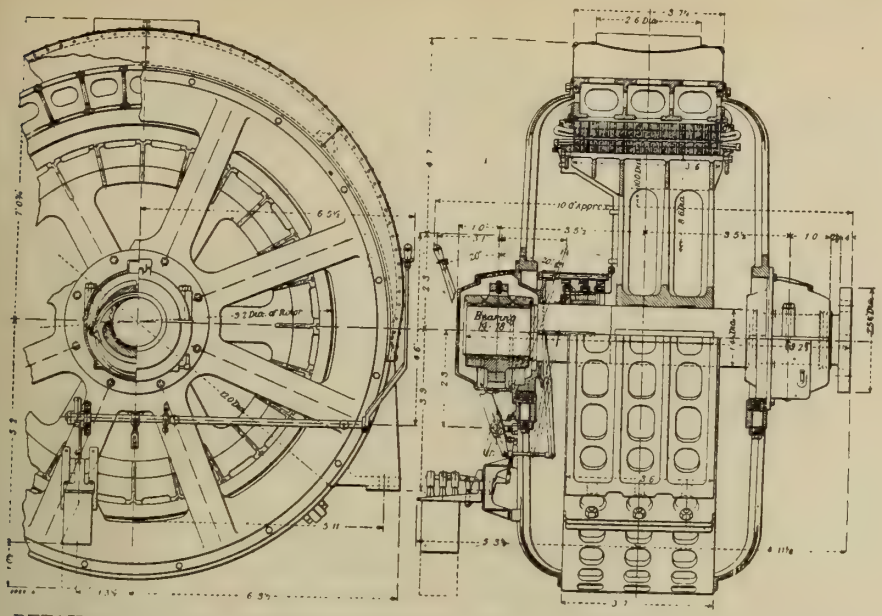
With an indicated horse-power of 750 she made a speed about 9 knots. She was, however, considered inefficient and the experiments were dropped. In my opinion it would add considerably to the interest of the marine engineering profession if a further trial of hydraulic propulsion were made to-day. My views are that the efficiency development of both prime-movers, pumps, and hull design have gone further ahead than the development of the screw propeller since the "Waterwitch" experiments were made, and possibly some rather startling results may await those who continue the work, especially bearing in mind the facilities which are available in the form of electrically-operated high-speed rotary pumps, and the splendid control which can so easily be given to same. There is no question whatsoever as to the military advantages which a successful experiment would bring about for such vessels as warships or submarines, the propelling machinery is not only well down below water line but is also inside the vessel, and they are not so easily damaged by projectiles or torpedo under-water explosion.

The next great advance in the engineering development of marine transport was the creation of the "Great Eastern," which was propelled by means of both screw and paddle-wheel propellers, with direct-coupled steam engines, and had five funnels, was 680 feet long, 82 feet beam, and a loaded draught of 30 feet, the displacement was 27,000 tons, she had four decks and six masts, and being an auxiliary vessel she carried a sail area of 6,200 square feet.

Ample attention was given to safety by the provision of twelve transverse and two longitudinal bulkheads, the spaces being utilized as coal bunkers, the paddle-wheels were 56 feet diameter with float boards 13 feet long, and three feet wide, the screw propeller placed aft had four blades, was 24 feet diameter, and with a pitch of 37 feet. There were in all five boiler rooms supplying steam at a pressure of 25 pounds per square inch, the total indicated horse-power being about 8,000. She was, however, a vessel of dimensions much before her time, the thermal efficiency of the steam engine had not advanced quite far enough to warrant the displacement and commercial speed, and indeed signs are not wanting now that the size of steam propelled ships has again reached the limit of commercial application, unless a further increase of the thermodynamic propulsive efficiency accompanies the proposition of still larger and speedier ships.

The next big development was undoubtedly the building of the "Lusitania" and the "Mauretania," and this was possible by the adoption of the steam turbine as prime mover, and although the highest possible thermo-dynamic efficient was far from reached in those vessels, they undoubtedly went far to open up the problem of the big ship, together (at the time) with the most suitable method of propulsion for same. It is highly questionable concerning the

*Paper by Mr. J. R. Ruthven, No. xxi., Vol. II., September, 1890.



DETAILS OF MOTOR, SHOWING SWITCHING APPARATUS FOR STARTING RESISTANCE.

wisdom of putting in the heavy cumbersome cylindrical hand-fired boiler as the best that could have been accomplished, but these vessels have done good work in that field where operating expense evidently is not of the highest possible significance, especially under Government subsidies.

It is obvious, however, that, had water tube boilers been used, the displacement would have been decreased, and for a given vessel speed a reduced effective horse-power would have been required, which again is reflected in a reduction in the machinery weight, condenser plant, and bunker capacity for given radius at given vessel speed, and also what is to-day most serious, a considerable reduction in the amount of firing and trimming labor and cost.

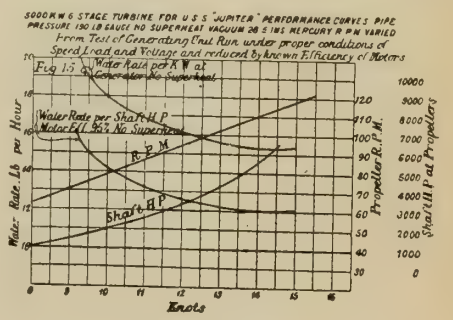
The successful running of the "Saxonia," which had this type of boiler, probably carried weight in the final decision, as she was undoubtedly a very efficient reciprocating engine propelled ship. Her boiler room equipment weighed about 1,000 tons, and over a run of 13 hours, during which period only six out of her 27 furnaces were cleaned, the evaporation was as much as 11.3 lbs. of water per pound of coal burnt, and the steam consumption per I.H.P. hour was as low as 13.26 pounds, which is equal to 1.175 pounds of coal per I.H.P. hour. The propellers were driven by slow speed engines indicating about 10,000 horsepower, the propulsive efficiency was approximately 60 per cent. compared with the I.H.P., so the effective horse-power would be, say, 6,000; this with a coal of a calorific value of 13,000 B.t.u. per pound, gives a thermo-dynamic propulsive efficiency of 10 per cent., which is a highly creditable result obtained under almost ideal conditions over a short period of time; the actual ocean-going results were probably only about eight to nine per cent., and even this is splendid work compared with the average tramp steamer, which gives something about five to seven per cent.

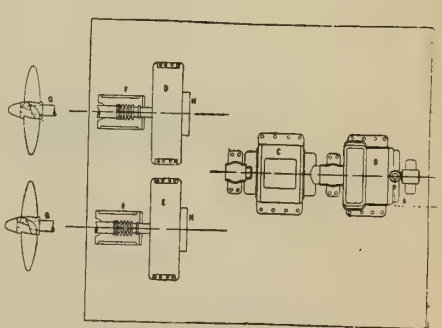
There is not much doubt, however, that the "Saxonia" represents the limit in thermal efficiency which can be looked forward to by means of the twin screw quadruple-expansion reciprocating saturated steam engined passenger ship, and her engineers can be well proud of their results.

Heavy, slow-speed reciprocating engines, although very greatly improved and brought up to a fine state of efficiency for such type of prime-mover, have, however, grave disadvantages, the greatest perhaps in the case of passenger and warships, the principal being the unavoidable vibration, as it is a natural law that a heavy revolving not exactly balanced body always runs unequally and transmits a tremor to anything with which it may come in contact. Large power engines of this type as is required for modern high-speed vessels of heavy displacement stand so high in the ship that their cylinders are well above water level, and this feature is of a special disadvantage in warships, and no doubt the principal reason why the steam turbine has replaced the otherwise comparatively speaking efficient reciprocating steam engine in most of the world's navies.

From a thermo-dynamic aspect, however, the steam turbine did not show up so good, and many ships are consequently retaining the reciprocating engine, there being no doubt about the fact that although the turbine did lie nice and low in the vessel, it did reduce the vibration, but it used so much steam and coal per effective horsepower, owing to its higher revolutions and consequent propeller inefficiency that it was too costly to use in ships which had to meet international competition on the seas.

Another feature in this matter was, in the case of a vessel having to slow down for any considerable length of time, the steam turbine, like its competitor, the Otto and Diesel internal-combustion engine, practically has only one efficient revolution speed at its rated load, and whereas the steam reciprocating engine could link up and take the fullest advantage of expansion at low revolutions and load, the turbine was unable to give such economical result, and this was particularly noticeable in the case of the trials of the "Lusitania." It was found that at 25.4 knots the coal consumption per shaft horsepower hour was 1.43 pounds (for 68,850 s.h.p.), whilst when the vessel was slowed down to 15.77 knots the consumption rose to 2.52 pounds, an increase of nearly 71 per cent. per shaft horsepower developed (13,400), at 20 knots the propulsive efficiency was about 52 per cent., but at 25.4 knots this fell to 48 per cent., while at the 15.77 knot speed this again fell to 40 per cent. The fuel used was a mixture of Welsh and Yorkshire coal estimated at a calorific value of 13,000 B.t.u. per pound, the consumption per effective horsepower was at 25.4 knots, 2.98 pounds, and at 15.77 knots, 6.3 pounds per e.p.h. hour, the heat unit, consumption per effective horsepower minute being respectively 645 and 1,366, the thermo-dynamic propulsive efficiency for the two vessels being 6.58 per cent. and 3.1 per cent. relatively, which indicates at least that the "Saxonia" with her quadruple-expansion engines, and with her slow running propellers, an increase in the thermo-dynamic efficiency of no less than 52 per cent., compared with the slow running turbines, and the comparatively speaking high speed propellers of the "Lusitania," the latter vessel suffering in the author's opinion by a combination of unfortunate events, as it is well known that if steam turbines are to give off their greatest power per unit fuel used in the process that they must run at high revolution speed, whilst on the other hand, in order that the screw propeller shall give its highest thrust per horsepower supplied to it, that it must run at a comparatively speaking





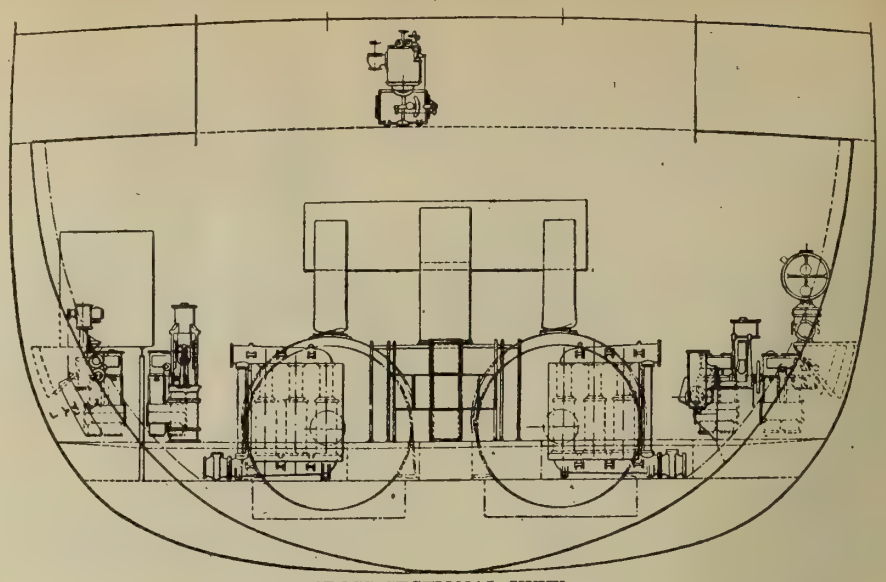
TEST PERFORMANCE CURVES OF PROPELLING MACHINERY.

much lower revolution speed, and have the area to utilize the power without excessive slip.

Besides, large area slow speed propellers have many other material advantages, particularly referring to rapid manoeuvring, for reversing, and are in better control of the vessel than small high speed, high slip turbine-driven propellers against strong winds and currents at sea, and vessels fitted with these bigger propellers are not so likely to be blown ashore, and these features are quite apart from the commercial one, namely, of requiring less fuel per 1,000 tons displacement per mile at any given speed.

Shipowners would be studying their own interests if in the future they were to put much more stress in contracts for ships regarding the fuel consumption per effective horsepower, as will be readily seen by the comparative results stated, reflecting on ship's operating costs, that it is not the fuel consumption per shaft horse-power which is the most significant, but the fuel consumption per effective horsepower hour which is commercially the most important thing of all, and by such attention the maximum efficiency, not only in connection with the propelling machinery, but also in hull and propeller efficiency, must then play a most important part in the competition for shipping plant.

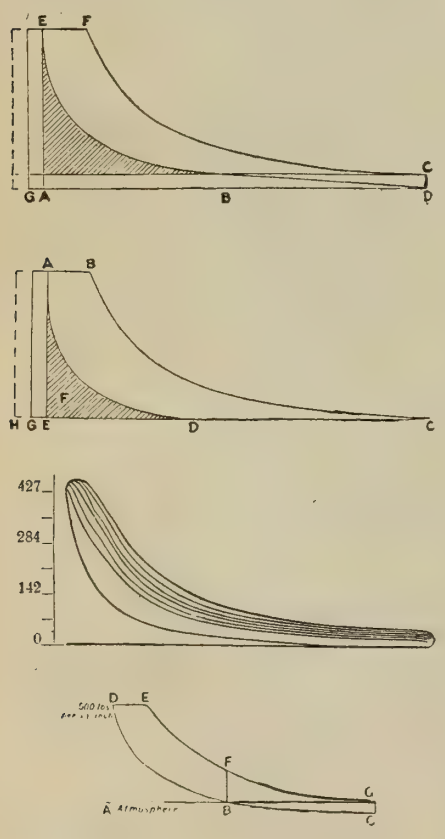
Knowing full well the limitations of both the steam turbine and the internal-combustion engine in regard to inefficiency at slow revolutions, and also both suffering from high fuel consumption at reduced revolution speeds, the complication and unreliability involved—if they were to be made reversible a higher propeller efficiency would be obtained if

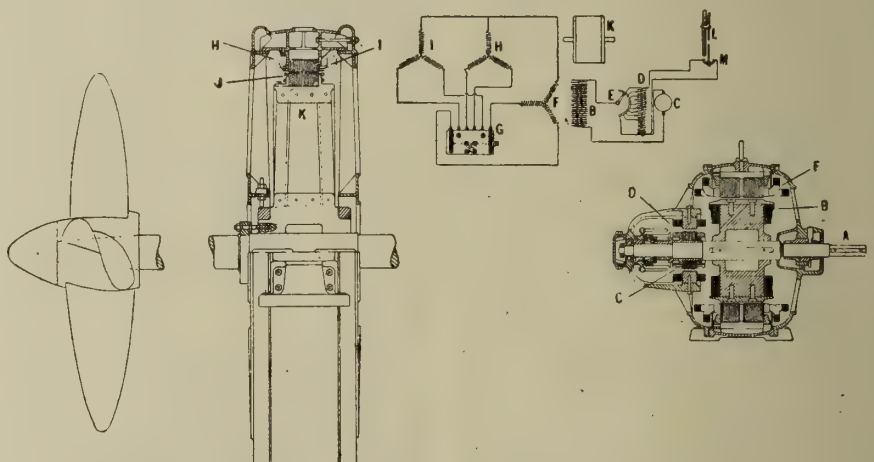


CROSS SECTIONAL VIEW.

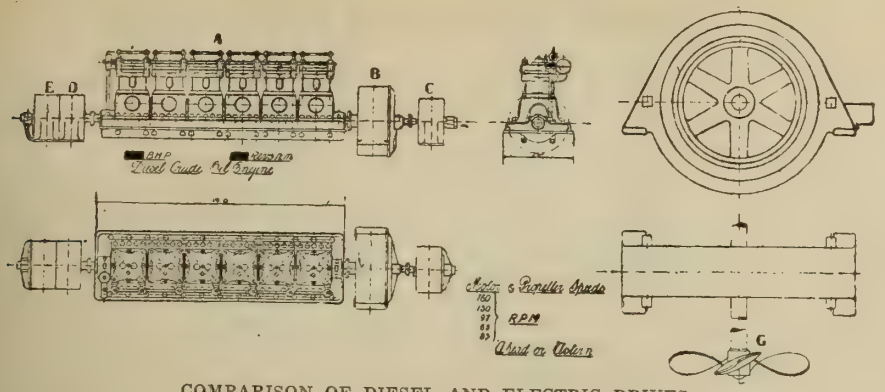
the turbine was direct-coupled and run at high revolutions (to obtain reasonable low steam consumption per shaft horse-power) and the cumbersome heavy weights and moving masses essential in slow speed direct-coupled reciprocating internal-combustion engines would be reduced.

The author in 1902 made some extensive experiments with a view of using mechanical reduction gears between the efficient steam turbine and internal-combustion engine when running at high revolutions and slow running large area screw propellers. The system was, however, not new, as it had been used on a boat on the Thames as long ago as 1785 in the 18th century, when, on May 9 Mr. Joseph Bramah, a fire engine maker of Piccadilly, London, obtained a British patent for using high speed steam engine and slow speed propellers for ship propulsion. The chief reason why the author dropped the idea in 1902 was the fact that although he searched not only Great Britain, but also North and South Europe, he could not get manufacturers to guarantee the manufacture nor the upkeep of such high-powered mechanical gears for which he was asking. The geared system, when applied with steam turbines had the material disadvantage of requiring two separate sets of turbines, i.e., one set for ahead and another set for astern operation, and in the case of installations such as would have been required for battleships, where the major part of their time is occupied at what is called cruising speed, say about 14 knots, instead of 22 knots, their full speed, it was found that it either meant the installation of extra expansion or what were called cruising turbines, the complication of which was considered too much, and the cost and space occupied too great, and even with all the mentioned features the thermo-dynamic efficiency was very low, not much better than was actually obtained with direct-coupled turbines, in fact, commercially speaking it was not worth the candle. A bright idea was, however, afterwards put forward, and this consisted of the installation of a distinct and separate set of cruising machinery, so that a ship fitted with four shafts would have no less than eight sets of propelling steam plant, in one case as many as 32 turbines were embodied in the plant for a single battleship, which indeed was somewhat humorous, indeed it must be thought in certain quarters that the hard-working





THE PARAGON ELECTRIC PROPULSION SYSTEM FOR SMALL POWER VESSELS.



COMPARISON OF DIESEL AND ELECTRIC DRIVES.

marine engineer had not enough on his hands already.

Further, in the geared system of turbine propulsion, each shaft wanted a complete installation of turbines, speed reducing gear, bearings, thrust balancing devices, steam and exhaust piping, and lubricating gear, all mechanically locked together, and as a practical engineer experienced with high revolution speed machinery, I have no hesitation in saying that such a locked together set of machinery is subject to many kinds of trouble, with any of its parts, one of which may easily necessitate the immediate stoppage of the whole system on that particular shaft, besides, the whole of the driving machinery has to be lined up with the propelling shafts and placed right aft, this necessitating long lengths of steam piping, reducing the steam pressure and increasing the radiation losses, besides always being liable to accident, which in itself is a very serious feature, especially in warships.

C.P.O.S. EMPRESS OF CANADA LARGEST PACIFIC LINER

The Empress of Canada, launched on 17th August, has two claims to greatness, she is the largest liner yet built by the Fairfield Shipbuilding and Engineering Co., Ltd., of Govan, and, when complete, will be the largest mail and passenger steamer on the Pacific Ocean. The new ship is intended to augment the Pacific service of the C.P.O.S. at present maintained by the "Empress of Asia," "Empress of Russia," "Empress of Japan" and "Monteagle." The principle dimensions of the vessel are as follows:

	Feet	Inches
Length over all	653	0
Breadth	77	9
Depth to bridge deck	53	6
Gross tonnage about	22,000	
Sea speed	18	knots

The ship will be propelled by two sets of Brown-Curtis turbines, driving twin-screws through double reduction gearing. This installation is the largest which has, so far, been constructed. The boiler installation comprises eight double-ended and four single-ended cylindrical return tube boilers, arranged in two separate boiler compartments and designed to burn oil fuel in combination with the Howden system of forced draught. In each boiler room there is a complete duplicate system of oil fuel pumps, heaters and fittings for supplying oil to the furnaces, and provision has been made for readily converting the boilers so that they may burn coal if required. The ventilating and heating system is very complete, the thermotank system of ventilation, steam and electric radiators being employed. The supply and exhaust fans are capable of changing the air throughout the ship a sufficient number of times per hour to ensure a continuous supply of fresh air. The thermotanks and fans are also fitted with an efficient disinfecting apparatus.

The 'tween-decks are sub-divided by fireproof bulkheads and in addition to the usual hydrants and hoses, chemical fire extinguishers are fitted throughout the passenger accommodation. A complete system of automatic fire alarms is fitted throughout the ship.

Brunton Brothers' hydraulic system of water-tight doors are fitted, a type that has proved very successful on other of the company's steamers. These are all controlled from the navigating bridge.

Lifeboats in excess of requirements, telephone system with central exchange, wireless telegraphy, submarine signalling, gyro compass and electric clocks form part of the ship's equipment.

Throughout the passenger accommodation special attention has been given to the fact that the Empress of Canada is to serve in semi-tropical climate, all rooms are therefore large and airy and the ventilation sufficient.

The accommodation provided allows the carrying of about 500 first class, 100 second, 240 third, 930 Asiastic steerage passengers and a crew of 550. First-class staterooms for one, two and three persons are on B deck and for two, three and four persons on C deck. In addition there are a number of private suites consisting of sitting room, bedroom and bathroom, and special rooms with bathrooms and rooms with private toilets. Amidships on D deck is the dining saloon which will accommodate 307 at one sitting, the tables being arranged for small parties of two, four or six people. It is approached from the reception room, and the general scheme of decoration is Georgian in character. The reception room, immediately forward of the dining saloon, has an area of 300 superficial feet laid with oak parquet flooring for dancing. At the forward end of the room is the main stairway and passenger elevator.

On A deck the main stairway opens into the long gallery which gives access to all the principal first class public rooms. It is 110 feet long and 13 feet wide; the sides will be panelled in polished Honduras mahogany and hung with choice prints. Forward of the long gallery is the lounge in which is a cinema operating room. At the after end is the smoking room, panelled in oak.

Opening from the long gallery are also the card room, drawing room, writing room and children's room. The smoking room gives on to the verandah cafe, decorated in an oak, half-timbered design. Forward of the reception room, and on the same deck, is a swimming bath 30 ft. long and 18 ft. wide with a maximum depth of 8 feet. Next to the swimming bath and communicating with it is a large gymnasium fitted with the most modern appliances.

Most of the public rooms, which have been designed by Messrs. George Crawley & Partners, the eminent London architects, have electric fires and are arranged to ensure the utmost comfort to passengers. Large promenade space is provided on the boat deck and A deck. The vessel is fully equipped with laundry, dispensary, hospitals, information bureau, and barber's shop and will carry a manicurist and stenographer. The design of the vessel was prepared by Mr. Hugh Macdonald, Naval Architect to the Company, and built under the supervision of the Owners' Consulting Naval Architects, Messrs. J. H. Biles & Co.

After completion the Empress of Canada will make a world tour on her way to Vancouver. She is scheduled to leave Liverpool in March 1921 and will proceed via Gibraltar, Monaco, Naples, Suez, Bombay, Colombo, Singapore, Kobe and Yokohama.

In connection with the forthcoming transcontinental air flight from Halifax to Vancouver, the Quebec Harbor Commissioners have been approached as to the using of Lampson's Cove as a seaplane harbor, which will serve as a permanent station for transcontinental flights, and will place Quebec on the all-red air route. Capt. Leroyer, of the Canadian Air Board, has stated that one of these flights will take place towards the end of this month. The object of these flights is not only of military value but it is to demonstrate the practicability of the airplane for commercial purposes.

Extending Canada's Trade to Every Harbor

Development of Canadian Marine is Proceeding on a Profitable Basis—Ships Are Now Sailing from Canada to Many Points—Equipment and Service of a Very High Order.

ALTHOUGH Canada has come into the world view in maritime matters of recent years, many of her people, far removed from the seaboard, are but dimly aware of her position in this respect. As a means of putting first hand information on the activities of the Government marine before these people, a party of press representatives from Toronto, Hamilton, Ottawa, London, Quebec, and Montreal were entertained to luncheon on board the "Canadian Victor," the latest acquisition to the fleet. The party travelled over Government-owned lines from their respective towns to Montreal, where the vessel was loading for Liverpool at Pier 12, Montreal. The Toronto and Hamilton representatives travelled via Napanee, Smith's Falls and Ottawa over the C.P.R., transferring to the Grand Trunk at Ottawa for the remainder of the journey to Montreal. The trip to Ottawa was made by daylight, and the scenic beauties of the route were much enjoyed by the newspaper men. The portion of the route through the Rideau chain of lakes is especially beautiful, and the excellence of the road bed contributed materially to the pleasure of the trip. The train at times made considerably over 60 miles an hour, and there was no evidence of the usual bumping and swinging which so often accompanies railroad travelling on the roads of this country. Montreal was reached about 11 p.m.

Luncheon on Board

Luncheon on board the "Canadian Victor" was set for 1.30 p.m. on Tuesday, August 21st, and at that hour a deeply interested company gathered around the table in the smoke room. Yes, the "Canadian Victor" has a smoke room in her accommodation, which is far in advance of that on any cargo steamer the writer has so far run across. The head of the table was taken by Captain Coffin, master of the vessel, while facing him at the other end was Mr. R. B. Teakle, manager of the Canadian Government Merchant Marine, who had on his right Mr. M. P. Fennell, secretary of the Montreal Harbor Commission and on his left Capt. S. E. Tedford, marine superintendent of the C.G.M.M. Besides the representatives of the press, there were present Captain Bourassa, Harbor Master of Montreal, Captain Bales, Port Warden of Montreal, Mr. H. Milburn, assistant manager of the C.G.M.M., Mr. H. J. Whiteside, publicity agent of the C.N.R.. and Mr. Walter Thompson, publicity agent of the G.T.R. During the luncheon, the subdued clatter of the winches rapidly lowering the cargo into the holds formed a bass accompaniment to the hum of conversation and served to remind one that this was no pleasure ship, but a busy commerce carrier, carrying Canada's goods and Canada's flag to the far confines of the Empire.

Mr. R. B. Teakle, in a post-prandial speech, gave a highly interesting and closeup view of the attainments of the C.G.M.M. from its inception to the present day, and the achievements that are aimed at for the future. Mr. Teakle's speech impressed one as that of a man who knew his subject thoroughly and was imbued with a very warm enthusiasm for the project he had under his charge. In fact, every official of the C.G.M.M. one meets seems to be infected with this same spirit.

Started After the War

Mr. Teakle spoke of the inception of the fleet, which was really started in order to keep the shipyards, then concluding their Imperial Munitions Board contracts, employed for a further period. The world shortage of shipping induced the Government to increase their earlier orders, and then the vision of what such a fleet might mean to Canada decided them to bring the fleet up to its present dimensions. The "Canadian Victor" was the 38th ship to be delivered, and brought the total tonnage now in commission up to 203,000 tons. There were 28 more steamers to be delivered, which would make a total of 400,000 tons dead weight and a fleet of 66 steamers. A fleet of this size was a very respectable one for any company to own. The first vessel to sail was the "Canadian Voyageur," a product of the same firm that had built the "Canadian Victor," the Canadian-Vickers, Ltd. At the end of 1919, the total tonnage in commission was 93,900 tons. The fleet when all are delivered will virtually girdle the earth, services being established to every part of the world. Close by the "Canadian Victor" the "Canadian Pioneer" was loading for Bombay, Calcutta and Kurrachee, while from the British Columbia coast the "Canadian Importer" and "Canadian Exporter" had inaugurated a service to Australia and New Zealand, Hong Kong, Shanghai and Japan, and the Dutch East Indies will have services and the Canadian vessels from the Pacific coast will meet in far Eastern ports with Canadian vessels from the Atlantic coast, thus forming virtually a girdle of the globe.

Training Canadian Officers

Not only were these vessels Canadian built, but they were 80 per cent. Canadian manned. In order to provide future officers from the youth of Canada every steamer carried two apprentices, selected from various towns in Canada. Mr. Teakle was one of the originators of the Navy League and through this organization many of the boys were supplied. These apprentices, after four years' service, would be eligible to sit for examination as junior officers, and then climb up the ladder in the usual way, until they attained the highest position attainable at sea. The "Canadian Victor" was the first of the Government vessels to be fitted with a cold storage hold, and some of the future vessels would probably be equipped with oil fuel. Speaking of the organization, of the fleets, Mr. Teakle mentioned that they had as Australian manager, Mr. Geo. E. Bunting, a Canadian of long experience and training in the shipping business, while in London, England they were represented by Mr. Wm. Phillips, also a Canadian. The ships were

ONE OF THE CANADIAN MARINE VESSELS

run in exactly the same manner as the large English companies ran their ships. In fact in some ways they were run better, and he instanced cases where Canadian Government ships were turned round in four or five days, while old country ships in the same ports took ten or fourteen. They handled in the port of Montreal as many as six or seven ships a week, and they came and went quietly with no fuss, but with full holds. So far the ships had been run at a handsome profit. It had been said, and there was some truth in it, that even if the vessels were run at a loss they would be of value to the country. However, that was not the view that he and his assistants took of it, and they were running them as a business organization, to make a profit for the owners, who were the people of Canada.

At the conclusion of his speech, Mr. Teakle was thanked very heartily, and congratulated on his clear exposition of the purpose of the C.G.M.M.

The "Canadian Victor"

Following Mr. Teakle's speech, the company were taken on a tour of inspection of the vessel, and the various features pointed out by the officers in charge. As before mentioned, the accommodation for all hands is very much above the average to be found in a cargo steamer, and there is in addition accommodation for eight passengers, should there be need at any time to carry someone from port to port. The men's accommodation under the poop is spacious and considerably better than used to be provided for third class passengers up till quite recently. The poop deck itself is long and spacious and makes an excellent promenade deck.

The facilities for handling cargo are very good, there being four winches at each hatch, besides one on the poop, and the anchor windlass on the fo'c's'le head. The steering engine is located in the poop, and is operated by telemotor gear from the wheel-house on the bridge. Hand gear is fitted in case of emergency and a powerful brake is fitted that can hold the rudder stationary in case of a breakdown of any part of the gear.

The vessel's leading dimensions are: 400 feet long by 52 feet beam and 32 feet deep, while her deadweight tonnage is 8,432. She has triple expansion engines, with the contraflo type condenser, the air pump and bilge pumps only being operated off the h.p. cylinder. A winch condenser is fitted for port use. The main feed pumps are independent, made by the well known G. & J. Weir, of Glasgow. There is also a Lamont pump. The circulating pump is of the centrifugal type. There are three boilers of the Scotch marine type, with three furnaces in each, operated under the Howden system of forced draught. Mr. McGregor, the chief engineer, had two vessels blown up under him during the war, but looks none the worse for his unpleasant experiences.

Canadian-made Goods

Going through the sheds afterwards under the guidance of Capt. Tedford, it was highly impressive to observe Canadian-made autos in huge crates consigned to India, and even Arabia. Those were part of the cargo of the "Canadian Pioneer," which was loading for these ports. At another shed was observed the "Canadian Observer," loading for Newfoundland and Gulf ports, while at another wharf the Canadian Government steamers have been the means of bringing 8,000 tons of Cuban sugar to Montreal, which otherwise would have been difficult to get. Captain Tedford becomes enthusiastic when speaking of the steamers of the fleet and claims that there is no line of ships that can show better operation than the C.G.M.M. He wants the funnel of the line to carry a maple leaf to distinguish them, and let everyone who sees them know that there is a Canadian ship. He rightly contends that there is no better advertisement for Canada than a Canadian ship in every port of the world.

A Little "Extra" Work

Despite the work of looking after a fleet, Captain Tedford is ready for any special duty that comes along. Quite as a matter of course he mentioned that he had lately returned from a little salvage operation on the coast of the St. Lawrence. The steamer J. E. McKee went ashore on the rocks at the mouth of the Saguenay River in a thick fog, and at high tide. A vessel going ashore at this place under these conditions usually stays there, and most people thought that the McKee would. However, Captain Tedford thought she could be salvaged and proceeded to salvage her. They left Quebec for the scene of the wreck in the afternoon and arrived at 2 o'clock the following afternoon, which was a Saturday. At 2 o'clock Sunday the vessel was afloat, after a portion of her cargo had been discharged. Her propeller was gone and her rudder badly damaged but she was towed into Quebec three days after the expedition started. This was a highly successful and expeditious salvage feat, for which Capt. Tedford came in for many congratulations.

Canada possesses an organization in her merchant fleet which is a distinct asset to the country. It is carrying her flag to countries which have hardly heard of her, and incidentally opening up trade routes for her manufacturers. The company, for it is a company, is to be congratulated on the men it has secured to organize and operate the fleet. The fleet is Canadian-built and 80 per cent. Canadian manned. May it soon be 100 per cent. Canadian and 100 per cent. successful.

Mr. H. J. Whiteside, of the Canadian National Rys., and Mr. Walter Thompson, of the Grand Trunk Ry., were responsible for the guidance and comfort of the party, and were tireless in their efforts for the well being of their guests.

COMMERCIAL TRAFFIC IN FIRST SIX YEARS

The Panama Canal completed 6 years of operation at the close of business on August 14, 1920, having been opened to commence on August 15, 1914. During the 6 years the total number of commercial ships making the transit was 10,573. The aggregate net tonnage, according to the rules of measurement of the Panama Canal, was 34,540,266 The cargo they carried totalled 40,313,629 tons of 2,240 pounds.

This traffic was made up of 4,934 ships, of 16,145,434 net tons, carrying 16,576,778 tons of cargo from the Atlantic to the Pacific, and 5,639 ships, of 18,394,832 net tons, with 23,736,851 tons of cargo from Pacific to Atlantic. Details of the traffic by calendar and fiscal years are presented in the table on pages 2 and 11.

The Canal was opened shortly after the beginning of the war in Europe. This and the interruptions of traffic due to slides, the last serious one of which came to an end on April 15, 1916, interfered with the normal use of the Canal in its earlier years, and government requisitioning, high freights, scarcity of tonnage, financial and industrial uncertainties, and fueling difficulties have since the signing of the armistice delayed the establishment of what may be considered the conditions of unrestricted commerce. A distinct and healthy growth of the traffic is, however, discernible, especially in the calendar year 1919 and the fiscal year 1920. Each of these, in ships and net tonnage, exceeded all previous years; and the fact that the traffic in the month and a half of the current fiscal year, beginning July 1, 1920, has been at a rate greater than that of any of the preceding years, indicates a continuing upward trend.

The Superheater Company, Limited, will manufacture the type of fire-tube superheaters now in general use in locomotives of all Canadian railways, and also fire tube superheaters for marine installations, of which there are now over two thousand in daily service. In the case of the water tube boilers in marine service, the company designs and manufactures the superheater to suit each individual case. This likewise applies to stationary installations, either water-tube, fire-tube, or separately fired. The conditions are studied in each case with a view to supplying the most economical and effective installation. The company employs a form of return bend which is made by a forging process from the metal of the superheater pipes, making an exceptionally strong construction which is proof against high temperatures. This form of return bend has also been considerably sought after for the use in pipe coils for refrigerating purposes, condensers and other uses.

The General Survey of Engines and Boilers

This Article Deals in a Descriptive Manner With the Work Necessary to Put a Ship's Engine Through Lloyd's or Board of Trade Survey

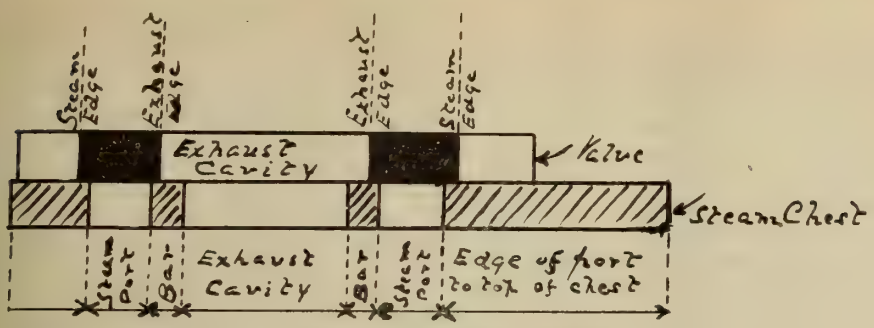
By T. H. FENNER

BEFORE dealing with the method of setting slide and piston valves, a short talk about the examination of the intermediate and low pressure valves will be useful. In the majority of triple expansion engines, the low and intermediate valves are slide valves. In very large engines, a balance piston is fitted on the end of the slide valve spindle, in order to relieve the gear of the weight of the valve. This consists merely of a steamtight piston working in a small cylinder and so proportioned that the product of the steam pressure per square inch on the area of the piston is just sufficient to carry the weight of the valve and spindle. The steam pressure is that which is on the back of the valve, and the top of the piston is usually in communication with the condenser so that any slight leakage past the piston is immediately carried away. It is usually the low pressure valve which is fitted in this way, the intermediate valve very often being equipped with a relief ring, as described in a previous article. The low pressure steam chest is sometimes made on the after end of the low pressure cylinder, in which case a cover is fitted which can be removed, exposing the whole area of the valve, but usually low pressure valve is cast between the intermediate and low pressure cylinder, and a small cover fitted on the top. The intermediate valve is always between the high and low pressure cylinders, but the high pressure valve is in many cases fitted right alongside the intermediate, the same cover doing for both.

Examining the Slide Valves

In examining the low and intermediate pressure valves, the procedure is about the same for both. The cover is removed, and then the top nuts on the spindle are slacked off. There are always two nuts on the top and two on the bottom of the spindle, a main nut and a lock nut in each case. These are invariably of a bronze mixture, gunmetal or some such allow, and a bronze washer is fitted between the nuts and the body of the valve. Brass nuts are used in order that they will not seize and rust on the spindle, and become immovable. It is not unusual to fit split pins on account of the necessity of making adjustments. The nuts if properly tightened up will never slack back. When slackink off or tightening up, two spanners are used, and as there is not a great deal of room, special spanners are usually made for the purpose. These have the shanks set at right angles to the jaws, and the top of the shanks are swelled out and have holes in them at right angles to each other. A podger bar is inserted in these to turn them. The shanks are made long enough to project above the top of the cylinder casting, making ample room for the bars to be inserted and turned. The spanner on the lower nut is held firmly, while the top nut is slacked back. A couple of sharp blows on the podger bar with a hammer are usually necessary to give the nut a start and once it moves, it is easily slacked back. The nut should be a sufficiently good fit on the thread to require slacking back with the spanner for a few threads after being started, and then should turn easily by hand. If it comes back by hand all the way it is too slack, and a new nut should be made, a proper fit on the thread. This is true of both the lower nut and the jam nut. When the nuts are off, eye bolts are screwed into the top of the valve and the valve is drawn off the spindle by a pair of chain blocks suspended from the I beam over the cylinders. Once the valve is clear of the spindle, and raised above the cylinder, a couple of blocks are placed under the lower edge, and the valve lowered onto these and tipped over backwards. so that it will lay face upwards when finally lowered. Two more pieces of wood are placed under it lengthwise for it to lay on, and then it is lowered away. It is then in a convenient position to work at. The first job is to thoroughly clean the face with kerosene, or as it is usually called on this side, coal oil, and the oil grooves on the face cleaned out thoroughly. The valve face will usually show a bright surface, with a very high polish, and if there are any low spots, these will be immediately recognized by their dull appearance. There may be a few of these which will not greatly matter, but if they extend to the outside edge of the valve face from the port, then the valve must be faced up. It is a good thing to try over the face with a steel straightedge and a set of feelers, which will disclose the low spots by the feeler slipping in between the straightedge and the valve face. This should be done very carefully and the full extent of the low spots noted to see if the valve needs scraping up or not. It is not a job to be lightly undertaken, as there is a large surface to be gone over, and the scraping up of the valve means also the scraping up of the valve seat, or steam chest face. As this is in a very closely confined position, it is about as hard and tedious a job as can be imagined. Sometimes the steam chest is fitted with a false face, held in position by counter sunk headed brass tap bolts. In this case the face can be removed, and valve and ceat trued up to each other in comfort. Generally speaking, it is seldom this is required, as the tendency is for the two surfaces to wear each other to a perfect fit. However, it is occasionally necessary and is caused by the nuts on the valve spindle being screwed too tight on the valve so that it has no play on the spindle, or through the block on the quadrant being set up unevenly, and throwing the spindle out of line. The oil used in lubricating has a tendency to harden at the port edges and form a thick hard sediment like a scale, and at end of the travel a similar condition arises, a ridge being formed. This should be carefully scraped away. The steam chest face should also be well cleaned, and the oil grooves cleaned out, and sometimes these need making a bit deeper due to wear. This is done by chipping them out with a round nosed chisel in the ordinary way. When working at the steam chest face, or valve seat, the ports should be carefully closed up with bagging or waste to prevent anything getting in the port and so finding its way to the cylinder, where it may do damage. Where a false face is fitted, the brass bolts which hold it in place should be carefully gone over to make sure that none are loose. There have been severe breakdowns caused by one of these bolts slacking back, and working out until it projected over the edge of the face. In such a case the bolt may be simply sheared off, but very often it has resulted in a large piece being broken off the valve or the face, rendering it useless. These bolts are made with a deep slot in the head, in which a strong screw driver may be inserted to tighten them up.

While the valve is out, the packing gland should be taken down and the packing removed from the stuffing box. The end of the valve spindle should be disconnected from the block on the quadrant, and lowered by means of an eye bolt in the upper end, far enough to make an examination of the part of the spindle which works through neck bush, packing and gland. This may require smoothing up with a file, or if scored very badly, sent up to the shop and turned up. The neck bush should be examined, and if necessary renewed. After the spindle has been smoothed up, and put back into place, the cap of the spindle end should be tightened hard up on the block, and the alignment of the spindle in the stuffing box and neck bush noted. It should stand absolutely central. If it is bearing hard on either side of the neck bush, the bearing should be filed out to bring it square, exactly



STAFFS FOR SETTING VALVES

in the manner we described for the top and bottom end of the connecting rod. It only remains then to replace the valve on the spindle and check up the leads, top and bottom.

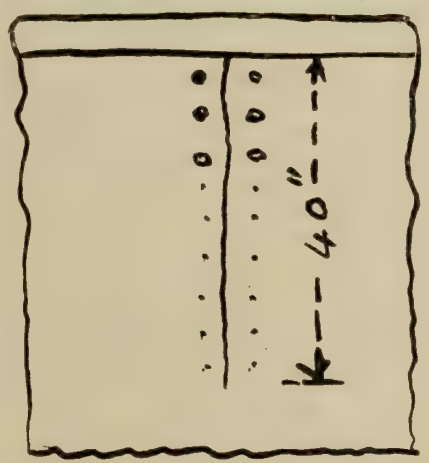
An important point to observe when replacing the valve nuts is to guard against jamming the valve. If the nuts top and bottom of the spindle are bearing hard on the valve, it may easily prevent the valve going up against the seat or may throw it out of the vertical, causing it to bear hard on top or botton of the stroke. If too much slack is left it will result in very noisy working, the valve striking the washer at every reversal of stroke. The nuts should be set in such a way that while there is no perceptible play up and down between valve and nuts, it is possible to move the valve by means of a bar horizontally between the nuts. This ensures it being kept up to the face when working by the steam pressure on the back. It is difficult to explain in writing just how to make these adjustments, it being a matter of the sixth sense which every good engineer develops in making adjustments.

Checking the Leads

When the valve is set back in the spindle in the position from which it was taken off, the adjustment must be checked. When the valve is easily accessible at top and bottom edges this is merely a matter of turning the engine on top and bottom centres, and measuring the opening of the ports to steam at the beginning of the stroke. To measure this accurately, it is usual to employ hard wood wedges, which are finished up smooth on all sides. The wedge is rubbed over with chalk, and then pushed into the opening of the port until it becomes tight. It is then withdrawn, and the mark of the port edge will be plainly seen at the point where the wedge became tight. This is then callipered carefully, and the lead ascertained. When one cannot get down to the bottom port to do this, it is necessary to employ other means. Two staffs are prepared, one showing the openings on the steam chest face, and the position of the first port in relation to the top of the casting. The second staff is made from the valve, and the two when laid together represent accurately valve and steam chest. When ready to use them it is only necessary to measure down from the top of the casting to the edge of the valve. The staff which represents the valve is then laid on the staff representing the steam chest in exactly the same position, and the opening of the ports can be plainly seen. These staffs are usually made in the erecting shop, and sent out as part of the ship's equipment, and are kept in the second engineer's room along with the soap, sweat rags, and other precious material which is treasured carefully by most second engineers.

AN UNUSUAL WELD

A repair job of interest to all engineers was recently carried out by means of the electric arc welding process to the main engine cylinder of the steamer Chippewa.



SHOWING CRACK EXTENDING 40 in. DOWN FROM TOP OF CYLINDER, STUDDED READY FOR WELDING.

Our readers will be familiar with the Chippewa's old-fashioned beam engine or "walking beam," as it is sometimes called. Needless to say the engine only has one cylinder, so that when a vertical crack some 40 inches long developed in the cylinder wall during the busiest part of the season, something had to be done about it. The cylinder is 5 ft. 6 in. in diameter by 12 ft. long, and carries a working pressure of 60 lbs. per sq. in.

After consultation with the Lincoln Electric Co. as to the possibility of successfully welding the crack, it was decided to proceed with repairs as quickly as possible, by means of a method which has been very successful in repairing large iron castings subject to heavy working stresses.

Holes were drilled down each side of the crack, and steel studs were screwed in and cut off about 3-4 in. from the cast iron. By the time the last stud was in, the Lincoln Electric Co's. motor truck carrying the portable electric welding outfit was on the dock within 20 feet of the Chippewa's engine room. The cables were connected up and the welder went to work to weld those studs and the cast iron of the cylinder into a solid mass of metal. Twenty-four hours later the job was complete and shortly afterward the Chippewa steamed out into the lake for a trial trip.

The weld was found to be quite tight and appeared to be a perfect job. The Superintendent Engineer deemed it advisable, however, to make assurance doubly sure by re-inforcing the weld with two steel bands placed right around the cylinder.

Electric arc welding has been used extensively of late along the water-front in Toronto for boiler and hull repairs but this is one of the first local instances that has come to our notice of the use of the process for a major repair to a large and important iron casting.

FINISHED WELD RESEMBLING STEEL PLASTER ABOUT 1 IN. THICK, APPLIED TO OUTSIDE OF CYLINDER WALL FOR FULL LENGTH OF CRACK.

Note:—It was found that this method of welding had the effect of drawing the edges together and closing up the crack as the weld was made, from the bottom up.

BOOK REVIEW

The S. Severance Manufacturing Co., of Glassport, Pa., are at present preparing the publication of a book on rivets, with the title "Rivets." This will be of a nature to interest all users of rivets, including designers, engineers, purchasing agents, etc. This, it is understood, is the first book of its kind to be published.

W. J. MacGowan, marine representative of the Sherwin-Williams Co., of Canada, Ltd., is making a business trip through Eastern Canada ports the latter part of September. Mr. MacGowan

THE MOTOR SHIP "THEODORE ROOSEVELT"

The latest motor ship to be delivered from the yard of Burmeister and Wain, of Copenhagen, is the "Theodore Roosevelt," of which we given an illustration above. She is a vessel of over 7,000 tons register, and has been built to Lloyd's class 100 A 1 +, for an awning deck with freeboard, and is further classed by the Norwegian Veritas. She is a sister ship to the motor ships formerly built for Fred Olsen and Co., Christiania, viz., the George Washington and the Bonheur, only with the exception that the George Washington has a shelter deck and correspondingly smaller draught. The George Washington has already made numerous voyages, but the Bonheur had the misfortune, during her first voyage from Christiania to Hull, to be blown up by a mine and sunk.

The leading dimensions of the Theodore Roosevelt are as follows:

Length overall	444 ft. 4 in.
Length between perpendiculars	25 ft. 5½ in.
Breadth of frame	55 ft.
Depth from awning deck	38 ft. 6 in.
Depth from upper deck	30 ft. 6 in.
Depth from lower deck	22 ft. 6 in.
Height of double bottom	3 ft. 8 in.
Draught, loaded	29 ft. 1 in.
Displacement	15,065 tons
Gross tonnage	About 7116 reg. ton
Carrying capacity	567,700 cub. ft. grain
	524.400 cub. ft. bales
Water ballast	1422 tons
Fuel oil capacity	1282 tons
Radius of action	About 30,000 miles

The ship is rigged with three masts, and has one 25-ton derrick, one 10-ton derrick and ten 5-ton derricks. She has five hatchways, fitted with eight 3-ton winches and two 5-ton winches, one electric anchor windlass, one electric warping winch, and one Brown Brothers electric hydraulic steering gear. The deck machinery is all wound for 220-volts, and the lighting installation wired for 110 volts. The ship is, of course, equipped with a wireless installation. Accommodation for officers and passengers is arranged amidship, there being space for ten passengers. The accommodation for the crew, which is arranged in the form of cabins with bunks for two men in each, is right aft.

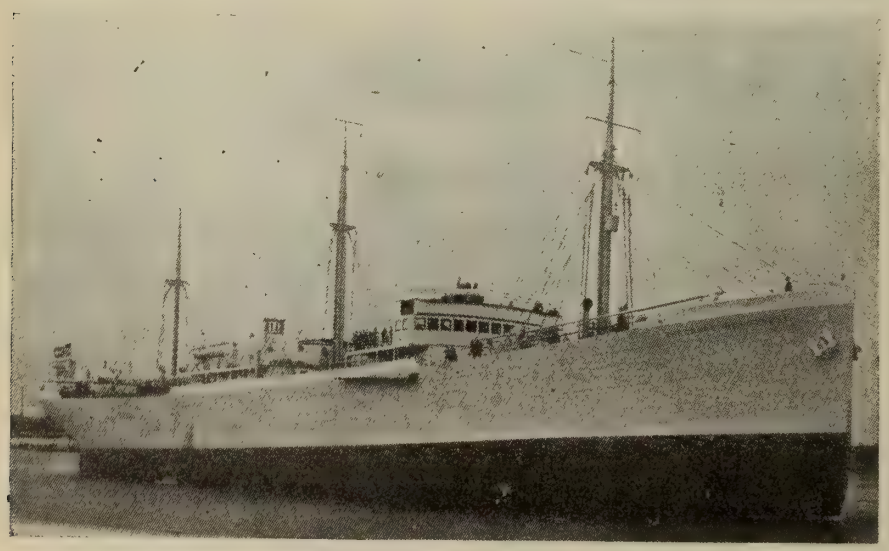
The main machinery consists of two six-cylinder single-acting four-cycle Diesel engines of the Burmeister and Wain crosshead type, enclosed and fitted with forced lubrication. The engines each have one three-stage air pump for injection air, and one fuel oil pump for each cylinder. No other pumps are driven directly from the main engines. The engines develop normally at sea 3,100 indicated horse-power when running at 125 revolutions per minute, the speed of the ship being about 11 knots at full load. The propellers are of manganese bronze with four blades, 12-ft. in diameter and 9 ft. 3 in. pitch.

The auxiliary generating sets consist of three enclosed, forced lubricated Diesel engines, also by Burmeister and Wain, each coupled directly to a continuous-current dynamo of 60 kilowatts at 220 volts. These engines give the necessary current for working all the auxiliary machinery on the ship, electric winches, steering gear and for lighting purposes. The auxiliary machinery comprises:—Two cooling water pumps; two sets of pumps for forced lubrication; two sets of bilge, sanitary and piston cooling water pumps; one ballast pump, with a capacity of 150 tons per hour; one pump for pumping up the daily supply of fuel oil, with a capacity of 50 tons per hour; and one manoeuvring and space air compressor. All these pumps are driven by 220-volt motors fitted with ordinary air-cooled starters.

For heating purposes there has been installed an oil-fired donkey boiler, which also supplies steam for working a small auxiliary compressor for pumping up air bottles, if all the compressed air should be lost.

It is estimated that the fuel oil consumption will be about 10½ tons per twenty-four hours, and with the fuel oil capacity mentioned above the ship will have oil enough for about 120 days at full load or some 30,000 miles. The engine-room staff consists of twelve men, officers and crew included.

During the trial trip with the vessel light, one run was made north and one south over the measured mile, with the following result:—North: 2,928 indicated horse-power, 133.65 revolutions, speed 11.58 knots; south: 2,936 indicated horse-power, 133.65 revolutions, speed 12.37 knots. The draught was 5 feet, 8 inches forward and 13 feet, 9 inches aft, giving a mean draught of 9 feet, 8½ inches. The displacement was 4,454 tons. —The Engineer.



THE MOTOR SHIP "THEODORE ROOSEVELT."

CUTTING THE "CANADIAN RUNNER"

There was recently launched and completed at the yards of the Port Arthur Shipbuilding Company, Limited, Port Arthur, the Canadian Government owned steamship "Canadian Runner." The following data give in detail the general dimensions and information on hull and machinery:

Hull

	Feet	Inches
L. O. A.	335	0
L. B. P.	320	0
Breadth, molded	44	0
Depth, molded	25	0

Engine and Boilers

Triple Exp. Eng. 23-in—38-in.—63-in x42-in. stroke.

Two Scotch boilers, dia., 15ft. 0-in.x 11 ft. 0-in. long.

Steam pressure 180 pounds.

Speed, loaded 11 knots.

This vessel, which was built under the requirements of the highest class of the British Corporation for the Survey and Registry of Shipping, is of all steel construction, and carries a complement of forty of a crew. As will be noted from the length of the vessel, which is intended for salt water service, it is too long to navigate the canals necessary to reach Tidewater, and has passed through the unique experience of being fully completed by the builders at Port Arthur, and then given a full load of grain, consigned to a Lake Erie port and, after discharging her cargo, was then placed on the nearest available dry dock and cut in two sections. This is the first time that a vessel has been built at the head of the lakes under these conditions.

After being placed on dry dock for cutting, the method of procedure was to locate the point of separation and cut adrift all connecting members and then, with the aid of timbers and blocks placed under the forward end, pull that section clear of the main and heavier part of the ship, the stationary after end

containing the power plant and crew's quarters, neither of which were disturbed by the cutting. Previous to and during the time the vessel had been placed on dry dock, bulkheads had been constructed just forward and aft of the cut for the purpose of preventing water from enter the open ends of the hull, thus ensuring sea-worthiness, and the limited draft required to navigate the canals. When the watertightness of the bulkheads had been tested thoroughly and the temporary pumping arrangements installed on the forward section, the dry dock was flooded and both ends floated, at which time a little trimming was necessary, and was taken care of by some water ballast in the tanks and with coal, and the ship, then in two pieces, was ready for the last leg of the journey.

The passage through the canals was accomplished with the aid of four lake tugs, there being two tugs attached by hawsers on each section, which towed and guided the helpless halves across Lake Erie, through the Welland Canal, across Lake Ontario, and down the St. Lawrence River into the Cardinal Lock, into the Galop Canal and on through to Morrisburg, Cornwall and Lachine Canals into the Port of Montreal, a journey of approximately 500 miles and consuming a week's time.

On arrival at Montreal, the sections are again placed on dry dock and skids are placed under the bow and the ship is pulled back to its original position, and the temporary bulkheads and pumping arrangements dismantled and removed, and the disturbed material repainted and the vessel will then be formally turned over to the Canadian Government.

At this writing both sections of the Canadian Runner" have arrived safely t Montreal and are awaiting their urn on the dry dock.

NEW STEAMER FOR FRANCE

On Tuesday, 31st August, 1920, Sir aylton Dixon & Co., Ltd., launched from heir Cleveland Dockyard, Middlesrough, the second of eight similar vesels which they are constructing for La ompagnie des Chemins de Fer de Paris, yon et Mediterranean whose shiping business is managed by their subsiiary company, La Societe Nationale Affretements.

The vessel is being built to a very igh class specification and has been pecially designed to fulfill the requirents of the owners' particular trade, her rincipal dimensions being 400x56x moulded with a deadweight capacity about 8,900 tons on a light draft of ater, and is being built under special rvey to receive Lloyd's highest classication also to meet the requirements of rench law.

The steamer is a single deck vessel the builders' well-known cantilever amed type which has proved so successful for the coal and other bulk car trades. This system of construction renders the ship a complete self-trimmer and gives the steamer greatly increased water-ballast capacity which in this ship will be about 3,500 tons, enabling the ship to make satisfactory voyages under light conditions.

Captain's accommodation will be provided in a large house on lower bridge with wireless room and charthouse on top. Saloon and officers' accommodation will be located in house on bridge deck amidships, while engineers' and petty officers' accommodation will be found in houses on poop deck at casing sides. Crew will be berthed in poop 'tween decks.

The vessel has four large self-trimming holds, which are absolutely clear of any beams, pillars or other obstructions whatever, and cross bunker. The 7 large hatches are to be fitted with Hogg-Carr patent hinged steel covers, and the steamer will have 2 masts at which will be fitted derricks for raising and lowering these patch covers, everything being specially designed with a view to the vessel being loaded and discharged by means of grabs.

Wireless apparatus will be installed and the ship will have 2 lifeboats with Welin's davits, 2 dinghies, electric light throughout, also 5 steam winches and steam windlass by Clarke, Chapman & Co., as well as Wilson-Pirrie steering gear by Donkin & Co. with telemotor control and a special mechanical system of ventilation in crew's quarters and in engine room. All equipment is one grade above Lloyd's rules.

Water-ballast will be carried in cellular double bottom, aft peak and two large fore peak tanks and in top-side tanks.

Quadruple expansion engines, placed aft, having cylinders 23, 32½, 47 and 68 by 48 stroke, supplied with steam by three large single ended boilers working at 220 pounds pressure, having Howden's system of forced draught, will be fitted in this vessel and three sister ships by the North Eastern Marine Eng. Co., Ltd., Wallsend-on-Tyne, while the remaining four vessels will be similarly engined by Richardsons, Westgarth & Co., Ltd., Middlesbrough.

On leaving the ways the vessel was gracefully named "P.L.M. 21" by Mrs. Eyres, wife of Mr. Reginald J. Eyres.

The vessel and her machinery are being constructed under the superintendence of Monsieur Marechal and Captain Veyrat of La Societe Nationale d'Affretements and Mr. Reginald J. Eyres, of Messrs. Eyres & Bryers, Newcastle-on-Tyne, Sunderland and Marseilles.

FUTURE U. S. CAPITAL SHIPS

The present naval programme of the United States is the most extensive ever undertaken by any nation. They are now rapidly completing six battleships of the Tennessee-New Mexico class, and while these vessels are to-day unequalled in naval power, they will become secondary as soon as representatives of two new classes are put into commission.

These new classes consist of battleships and battle cruisers, which will compare with the Tennessee as follows:

	Tennessee	New Battleships	New Battle Cruisers
Length overall, ft.....	624	684	874
Beam, ft.	97	105	90
Draught, ft.	31	33	31
Displacement, tons....	33,000	43,200	43,500
Speed, knots	21	23	35
Main battery, guns....	12 14"	12 16"	8 16"
Shaft horsepower ...	30,000	60,000	180,000

The new battleships are to be electrically driven, and the main propelling equipment of four of them—the "Indiana," "Montana," "South Dakota," and "North Carolina"—will consist of two Westinghouse 28,000 k.va. turbine generators and four 15,000 h.p. Westinghouse propeller motors. The turbines are to be of the complete expansion, impulse-reaction type, and will develop their full-rated load at 265 pounds, steam pressure, 50 degrees superheat, and 28½ inches vacuum. Electric energy will be generated in the form of 3-phase, 60-cycle, 5,000-volt alternating current.

The statistics of the new battle-cruisers given in the table indicate that these vessels are to be very unusual in many respects, but their most remarkable feature is the enormous power of their turbines—180,000 h.p. or 160,000 k.va.

These figures do not, however, give an adequate conception of the magnitude of this power. Not only is it greater than that of any ship ever designed—for the the power of the British cruiser Hood is 134,000 h.p. and that of the Leviathan 90,000 h.p.—but it is greater than that used by most cities of over half a million inhabitants. There are, in fact, but two or three steam-power plants in the world that have greater capacity than the engine rooms of these battle cruisers will have, so that, from the standpoint of power engineering alone, the construction of these vessels will constitute an achievement of the highest order.

Two of these vessels, the "Ranger" and the "Constellation," will have the following equipment:

Four Westinghouse main turbines to develop 49,750 B.h.p. each, with steam at 265 pounds, 50 degrees superheat, and 28½ inch vacuum.

Four 40,000 k.va. Westinghouse generators, directly connected to these turbines and generating 3-phase, 51.3 cycles. 5,400-volt alternating current.

Eight wound-rotor Westinghouse motors (two to each propeller), which are to be rated at 22,500 h.p. each, and will be the largest in the world.

The Wilt Twist Drill Company, of Canada, Ltd., Walkerville, Ont., have just recently published a very elaborate catalogue of drills, reamers and cutters, which not only lists the various types of tools but gives a description of the different styles and types and various suggestions on their proper uses. This catalogue is now ready for distribution and can be had by writing to the jobber or direct.

Eastern and Western Canada Marine Activities

September Correspondence

SIGNIFYING the determination of the Canadian National Railways to jump into trans-Pacific trade with both feet, announcement is made of a fast steamship that will be placed on the Pacific between the Government-owned mercantile marine, to be operated in connection with the Canadian National transcontinental system, and the Holt Steamship Company, of Liverpool, one of the best known British shipping lines. The two concerns will co-operate in maintaining a steamship service between Vancouver, Victoria and the Far East. This news, following close upon the announcement of Hon. C. C. Ballantyne, Minister of Marine and Fisheries, that the Cunard Line will place passenger ships in the trans-Pacific service in the near future to operate until such time as the Canadian Government Mercantile Marine is in a position to furnish its own boats for these routes. At least three large and fast steamships will be placed on the trans-Pacific run by the Cunard interests, according to Colonel Ballantyne. The service will be inaugurated before January and the vessels will operate on the Oriental side as far south as Singapore if present plans are carried out. It is the intention of the Government to place its own vessels in this service, and it is understood that the contract now being arranged with the Cunard Company will be for a limited period. Colonel Ballantyne stated that it was impossible for the Canadian Government Railways to compete with the Canadian Pacific Railway unless passenger liners were operated in connection with the roads, and plans to have the Cunard Line supply the link would give the service required.

Official announcement of the arrangement with the Holt Company follows:

A very important arrangement has been concluded between Messrs. A. Holt & Company, Liverpool, and Canadian Government Merchant Marine, Limited, and the Canadian railways, under which a joint steamship service is to be established between Vancouver, Victoria and the Orient, each steamship interest having a like number of steamers for joint service.

Under the arrangement made the Canadian Government Merchant Marine, Ltd., and the Canadian National Railways, will be represented in the Orient by Messrs. Butterfield and Swire, the present agents for the Holt interests, thus securing the advantage of a very old and strongly established organization. On the other hand, the interest of Holts will secure the support of the Canadian National Railways in the development for the benefit of the steamers in the joint service.

Richard Welsford, of Liverpool, son of J. H. Welsford, prominent British shipowner, has been appointed resident managing director of the Union Steamship Company of British Columbia, with headquarters in Vancouver. He succeeds E. H. Beazley, who was killed in an aeroplane accident a few months ago. John Barnsley, formerly of the Boscowitz Steamship Company and latterly assistant to Mr. Beazley, with offices in Prince Rupert, has been named manager of the company.

The Canadian National Railway System is contemplating the purchase of another steel car ferry to handle the business between Port Mann and Patricia Bay, linking up the mainland lines with the trackage on Vancouver Island. The car ferry Canora, with a capacity of twenty cars, has been in operation for about two years, and even though barges towed by tugs have been operated as well between the two points the service has been found inadequate, and the C. N. R. will probably ask Western shipyards to put in bids for a ferry to carry about eighteen cars. The Canora was built at Levis, Que.

Owing to the discount on Canadian money in the United States, Captain M. D. Harbord, of Victoria, and associates, have abandoned a project whereby a number of United States shipping board hulls now lying idle in Lake Union, near Seattle, would be purchased, rigged out as schooners, and operated in the lumber trade out of British Columbia ports. Capt. Harbord is a director of the Victoria Shipowners, Ltd., and head of the Vancouver Island Riggers' and Sailmakers' Association. The advance in the price of coal and oil and the increased wages demanded by crews have convinced Capt. Harbord that the sailing ship, particularly the economically-operated barkentine, is coming back. With donkey engines and other labor-saving appliances, he estimated a barkentine can be manned by a dozen men these days. He made a thorough inspection of the Shipping Board hulls and considered that their purchase would have been a good investment, but the difference in exchange appeared to him to also be the difference between profit and loss in their operation.

Under the house flag of the Isthmian Steamship Lines thirty-one big carriers will ply on the Pacific Coast-Atlantic and Pacific coast-European routes, according to advices received recently. It is expected that the boats will make at least weekly calls at southern British Columbia ports and Seattle.

The Canadian Government is definitely out of the shipbuilding business, but that is no reason why Canadian shipyards, created as a result of war's demands, should not continue to secure orders, Hon. C. C. Ballantyne, Minister of Marine, told delegations of shipping men, shipbuilders and business men at Vancouver, Victoria and Prince Rupert during his recent visit to the coast. The Government, he explained, helped to establish the yards so that they could handle war contracts. War business was discontinued, but now that the yards were on their own feet they should be able to compete with the world in ship construction, he believed, and he urged Canadian shipbuilders to make a great effort to secure orders from private interests and foreign governments. He explained the credit of $20,000,000 recently voted by the Government to aid the shipbuilding industry in Canada. Under this legislation it is necessary for the owner of the ship to advance only one-quarter of the cost. The builder puts up another quarter and the Government one-half. To protect itself the Government takes a mortgage on the whole ship. The plan was being worked out satisfactorily, the minister said, and he instanced the fact that the new legislation has assisted a yard at Three Rivers to take a contract for twelve steel tankers for France, and that yards in Montreal and Prince Rupert are also handling steel ship orders.

During the minister's visit to the coast representations were made to him with a view to having the Dominion Government place a contract for an ice-breaker with the Wallace Shipyard, North Vancouver. Ottawa authorized an appropriation of $1,500,000 for this work, but the Wallace tender, which was the lowest received, was somewhat over the allowance. He was urged to have the Government lighthouse tender Malaspina confined to inland waters, it being claimed that this vessel was just as likely to founder as the sister ship Galiano which was swamped in a heavy sea with all hands near Queen Charlotte Islands in October, 1918.

The Canadian Pacific Railway has awarded to the Wallace Shipyards of North Vancouver, the contract for the construction of a new coasting steamer to take the place of the Princess Sophia which sank with all hands in the Fall of 1918, on the Alaska and Northern British Columbia run. The vessel will cost $1,500,000 and will have a length of 325 feet. She will be specially constructed for navigation of northern waters and equipped with engines capable of developing a speed of 17 knots. At present the C. P. R. coast steamship service is handicapped by a lack of tonnage, and should it be necessary to withdraw any of the boats from service for a length period a serious situation might develop, particularly in regard to the northern runs. Captain J. W. Troup, manager of the coast service, recently went to the British Isles in an effort to secure suitable tonnage, but returned unsuccessful, and tenders were subsequently called from British shipyards with the result that the business was given to the Wallace Shipyards. A striking commentary on the cost of construction is afforded by the fact that the Princess Charlotte was built in 1908 a

a cost of $625,000, whereas the new vessel, which will be five feet longer, although of less horsepower, will cost more than twice that much. The contract is the largest awarded in British Columbia for a single ship. Four British Columbia yards submitted tenders: Yarrows, Ltd., and Harbor Marine Company, Victoria, and J. Coughlan & Sons, and Wallaces, Vancouver.

Advices received in Victoria indicate that the Royal Mail Steam Packet Company will resume regular sailings shortly between European and Pacific coast points. The vessels to operate in the service are not named in the dispatches but are said to be newly built and of some 12,000 tons each. The Royal Mail Steam Packet Company operated five "Shire" boats to this coast before the war, namely Cardiganshire, Carnarvonshire, Breconshire, Carmarthenshire, and Pembrokeshire. The service was crippled by tonnage losses during the war.

Airplane mail service will be established in October between Seattle, Washington and Victoria, it has been announced at Washington by Postmaster-General A. S. Burleson. The service is being undertaken to expedite delivery of mail from Oriental steamships to destinations on this continent. Victoria is first port of call for steamers from Japan and China and Australia and without the aerial service delivery of mail to and from the mainland is delayed several hours.

Efforts to salvage the C. P. R. steamer Princess Sophia, which sank with all hands in Lynn Canal, Alaska, in October, 1918, have been abandoned. The purser's safe, containing about $12,000, was recovered by divers, but little else was saved. A Seattle syndicate raised funds to raise the ship last winter, but after expending nearly all its money has become convinced that the venture is not profitable.

First work towards the construction of the big Ballantyne (Dominion Government) pier in Vancouver, was started September 1, when dredgers operated by the contractors, Grant & McDonnell, commenced scooping mud from the harbor bottom at the pier site.

The new freighter of the Canadain Robert Dollar Company, which has been named Esther Dollar, was delivered to the buyers August 27, according to advices received by Manager J. K. Burns. The vessel left the United Kingdom for New York September 4, and she will bring cargo from New York to British Columbia ports.

Commander Hugh E. Holme, R.N., the new superintendent of the Esquimalt navy yard, has arrived from Ottawa to take up his duties. Commander Holme was first lieutenant on the cruiser Rainbow, under Commander Hose during the early months of the war. Capt. E. H. Martin, R.N., formerly in charge of the navy yard, and who has resigned, will leave for England in a few days.

A record westbound Atlantic voyage was recently made by the Empress of France, of the C. P. O. S., when she made the trip from Liverpool to Quebec in less than six days.

On Sept. 1st. W. A. Cunningham was appointed acting general freight agent of the Canadian Government Merchant Marine with offices at 230 St. James St., Montreal. Mr. Cunningham will have complete charge of all traffic matters in respect to the C. G. M. M.

Denis Shanahan, bridgemaster of the Seigneurs Street bridge in Montreal, over the Lachine Canal, died on Sept. 1st after a month's illness. Mr. Shanahan was 70 years of age, coming from Ireland 47 years ago, when he entered the Government service on the Canal. He was in charge of the Wellington St. bridge for a number of years.

John H. McCallum, president of the Board of State Harbor Commissioners, of San Francisco, was a visitor to Montreal about the middle of the month, and took occasion to inspect the harbor equipment and facilities. Mr. McCallum was greatly impressed with the development of the Port and anticipated a great commercial future for Montreal and Canada.

The Canadian Runner, the C. G. M. M. steamer which was constructed in two half-sections by the Port Arthur Shipbuilding Company, and brought down to Montreal, where she was united at the yard of the Canadian Vickers, Ltd., will shortly be placed in service. She is a vessel of 4,350 deadweight tons, with a length of 320 feet and a beam of 44 feet. She will likely be placed on the United Kingdom route as a general cargo vessel.

An agreement has recently been concluded whereby the Canadian Government Merchant Marine and the Canadian National Railways will co-operate with the steamship firm of Alfred Holt and Company, of Liverpool, for the establishment of a trade route between Vancouver and the Orient. Mutual advantage is expected from this association, as Holt and Company has traded for many years in that part of the world and will be of great assistance in building up a trade between Canada and these countries. On the other hand, the Holt line will receive the benefit of the trade link with Canada which the C. G. M. M. and the Canadian National Railways can offer.

In view of the congested condition of the New York harbor it is interesting to note the recent visit of a number of American port authorities to Montreal, to look over the equipment and facilities of the local terminus, and take away a few facts relative to administration methods. Among the visitors on this occasion were Major-General George W. Goethals, consulting engineer; B. F. Cresson, junior consulting engineer; William R. Wilcox, J. Spencer Smith, De Witt C. Van Buskirk, commissioners; Julius H. Cohen, chief council; C. A. Ruhlman, assistant secretary; Lieut-Col. H. B. Salter, state auditor, New Jersey; State Senator S. Roy Heath. These gentlemen are gathering statistics on harbor conditions so as to remedy those existing in the port of New York.

Speaking recently before a gathering of Canadian Government Merchant Marine officials and other representatives of commercial enterprises, M. P. Fennell secretary of the Montreal Harbor Commissioners, gave out some interesting facts in connection with the Port of Montreal, emphasizing the economy with which the present splendid results have been achieved. The present harbor of Montreal has cost Canada less than thirty million dollars, is the second port in North and South America and the seventh in the world as to the value of the foreign commerce passing through the port. No other harbor in the world has anything like the value existing in Montreal for the same capital cost, and it now extends from Verdun to Bout de l'Ile, for a distance of about seventeen miles. The whole future development of Canada, said Mr. Fennell, depends to a very large degree upon the successful development of Montreal harbor.

As a result of the inquiry by Dominion Wreck Commissioner L. A. Demers, into the stranding of the Canadian Government ship, J. A. McKee, on the Lark Reef, on August the 26th, Jas. Lintlop, the master of the vessel, had his certificate suspended for a period of two months. The pilot, Edmond Papuet had his license suspended for the remainder of the present navigation season. The inquiry brought out the fact that the master of the vessel had taken a pilot at Father Point, although under no obligation to do so. The pilot, who had three years' experience, took the north passage from Red Island to save time, but his action in this respect was criticized by the court, as was also his failure to take more accurate bearings, not only of the Princess lightship, but also of the Red Island and White Island lightships. The weather was foggy but the vessel was maintained at full speed, with the result that it was embedded at full length amongst boulders, and, in consequence, 70 plates with frames had to be renewed. The court held that the master should have conferred with the pilot about the advisability of maintaining this speed, although he was a stranger in these waters. Master and pilot should have been united in having the speed of the ship reduced, soundings to be taken, and coming to anchor.

Activities of the Canada Steamship Lines for the present year and also in 1921, may be derived from the following statement of J. W. Norcross, president and managing director of the company: "So far as passenger traffic is concerned," he said, "our receipts are almost

G. & J. WEIR

Make Announcement of New Company

We wish to announce that the company of G. & J. Weir (Canada) Limited has been incorporated to take over the business of the Clyde Engineering Co., Limited, and will manufacture the complete **"WEIR"** line of auxiliaries for marine and land installations.

For this purpose land has been secured and work has been commenced on foundry and machine shops in Montreal. This extension has been found necessary as a result of the increasing demand for the G. & J. Weir products in Canada.

PEACOCK BROTHERS

SALES

(CANADA) LIMITED

The "WEIR" Specialties Comprise a Complete Chain of Auxiliary Machinery from Exhaust Pipe to Boiler

Weir Uniflux Condenser
Weir Turbine-Driven Circulating Pumps
Complete Weir Closed Circuit Feed System
Dual Air Pumps
Direct Contact Heaters
Weir Direct-Acting Feed Pumps
Weir Turbo-Feed Pumps
Weir Oil Fuel Pressure Pumps
Weir Oil Fuel Transfer Pumps
Weir Standard Evaporator
Weir Distilling Condenser
Evaporating and Distilling Plants
Weir Service Pumps

WEIR SERVICE!

To place the resources of our whole organization—technical, commercial, manufacturing and recording, at the service of our customers; to serve and assist them in every way we can.

To be definite: During our thirty years of concentrated scientific research and the application of the results secured, we have obtained considerable specialized knowledge. Our experience, our data and our results are at the disposal of any of our customers.

Then, our interest in our products does not cease when they are delivered. We make it our business to have our experts in attendance at all trial trips, to see to the proper performance and care of our auxiliaries.

Such is one of the central ideas of our organization—Weir Service. An idea which enables us to serve our clients efficiently, satisfactorily and to the full extent of our abilities.

LIMITED 179 Delorimier Avenue MONTREAL

GENTS

$1,000,000 in excess of those reported up to this time last year. The steamers operating on all divisions of the system have been patronized to an extent which surpasses all former records, with enquiries as to accommodations for next year of a nature as to indicate that business in 1921 will be well up to this year's record-breaking standards. Our hotels are booked almost to capacity for next year, after an excellent season in 1920. Freight business on the Great Lakes has also shown material growth, and with the Western crop movement now on, our earnings in this department will be well in excess of those of last year. It should be borne in mind, however, that operating expenses of water-carriers, like those of the railroad systems, have been subjected to substantial increases; labor is high, with other materials, notably coal, much over the levels of last year, but in the ultimate analysis of the result of 1920 operations, I am convinced we shall find that our net earnings will compare very favorably with those of 1919, which were, it must be remembered, the best in the history of the Canada Steamship Lines."

STANDARDIZATION OF STRUCTURAL SHAPES

On the entrance of the United States into the war with the Central Powers, there came a demand for immediate increase in ship construction which, in turn, meant increased production by the steel mills. To increase production to the minimum and to simplify order practice, a conference of steel makers was held in Washington on July 2, 1917, at which was adopted American standard practice for structural steel for ships.

The result of this action proved distinctly beneficial both to the mills and the shipyards, but was not followed immediately by a standardization of and a reduction in the number of structural shapes used at the yards, and in consequence the Emergency Fleet Corporation undertook an investigation to ascertain definitely the number of structural shapes used in shipbuilding and the possibility of their standardization and reduction in number. As an outcome of these investigations carried on by Mr. Fred T. Llewellyn in the Division of Steel Ship Construction under Daniel H. Cox, Manager, it became possible to determine what were the sections in most general use and at the same time were brought out clearly the divergencies in the sections rolled by different mills

At a conference of steel makers held in Philadelphia on November, 19, 1918, inasmuch as the British standard sections of ship channels and shipbuilding bulb angles appeared to be better adapted to economical manufacture than the American standard sections and inasmuch further as the new rolls which had been turned in recent years to produce sections conformed in general to British standards, it was decided that therefore American standard sections should be discontinued and that rolls not then to British standards be redressed at as early a date as possible to roll such sections as closely as possible to British standards and this particularly in view of the further fact that the adoption of British standard sections would enable American mills to compete on an even basis for ship steel wherever utilized in shipyards, either at home or overseas.

The British standard sections thus adopted as American standards were those adopted by the British Engineering Standards Association as published in 1903, and it was not known that this Association had undertaken a revision of the British standard sections in 1913, work on which, however, had been suspended by reason of the war activities. When, however, through the trade press, information as to what had been done in the United States came to the attention of the British Engineering Standards Association, that Association advised American steel makers as to the situation and later through their secretary, Mr. LeMaistre, expressed their desire to have the American structural trade co-operate with the British Engineering Standards Association in the formulation of common Anglo-American standards for structural shapes.

At the instance of the Association of American Steel Manufacturers, a Sectional Committee on Steel Shapes was organized under the auspices of the American Engineering Standards Committee. This Sectional Committee is composed as follows:

American Bureau of Shipping—Captain C. A. McAllister; David Arnott; John Martin.

American Society of Civil Engineers—J. H. Edwards; J. B. French; H. G. Balcolm.

Association of American Steel Manufacturers—R. B. Woodworth, (Chairman); G. H. Blakely; Geo. E. Thackeray.

Railway Car Manufacturers' Association—A. E. Ostrander.

Society of Naval Architects and Marine Engineers—Fred T. Llewellyn; E. H. Rigg; J. W. Stewart.

United States Navy — Commander C. M. Simmers; Lieut. Com. H. D. Rouzer.

The Sectional Committee gave very careful consideration to the entire routine of structural practice in the United States not only as it affects the profiles of structural shapes themselves, but also as regards methods of order practice, calculation and publication of weights, areas and properties, etc., with the idea to insure as far as possible a complete accord between makers and users wherever the sections rolled in English - speaking lands were used. At its meeting held on April 27, 1920, it formulated its recommendations for submission to its sponsor organizations, to the American Engineering Standards Committee and to the British Engineering Standards Association as a basis for common Anglo-American standards, and its conclusions are now to go before these organizations for further discussion and endorsement. The essential features of these recommendations are:—

1. The adoption of the decimal system for the expression of dimensions, thicknesses and other elements of order practice.

2. The adoption as an Anglo-American standard of the standard order practice adopted by the Association of American Steel Manufacturers on February 20, 1920, under which structural shapes are to be ordered by weights per foot and not by thickness.

3. The adoption as an Anglo-American standard of American standard practice as it relates to ranges of thicknesses, methods of computation and methods of publication.

4. The adoption of definite ranges in thicknesses of angles and other structural shapes, under which are established two zones of variations between minimum and maximum thicknesses. Under .60-in. thick variations are fixed at four one-hundredths inch (0.04-in.) and above .60-in. thick at eight one hundredths inch (0.08-in.)

5. Included in the list of angles is an equal angle (9x9) and four unequal angles (8x4, 9x4, 9x6 and 10x4) which are not now rolled in United States, but are subject to the considerations which weigh with manufacturers when new rolls are contemplated.

6. The adoption of a new line of bulb angle sections as proposed by the British Engineering Standards Association that are recommended on account of their greater efficiency as compared with present British and American standards.

7. The adoption of a single line of channel sections with a 5 deg. flange taper to displace the present two American lines, the structural line with its flange taper 9 deg. 27′ 42″ and the shipbuilding line with its flange taper of deg. This line of channel sections not quite in accord with that proposed by the British Engineering Standards Association, but is believed to be more suitable to the requirements of the American trade and better proportioned.

8. The adoption of a new line beam sections to take the place of the present American standards adopted 1896. These sections have wider flanges than present American standards and do not agree very closely with the British proposals, but are believed by the Sectional Committee to be more nearly in accord with the recent developments in the fabrication of buildings and bridges.

CLEARANCE IN GASOLINE ENGINE

Question

We would appreciate very much if you will publish in your next issue of Marine Engineer the proper size of combustion chamber for a marine gasoline engine. The engine is water cooled by a continuous stream of cool water being pumped through the engine while running. As an example, say we take an engine with a 5 in. bore and 4½ inch stroke, what is the proper size of combustion chamber when piston is up?

Answer

The amount of clearance or combustion space in a gasoline or any internal combustion engine, is governed by the required compression pressure. The compression pressure in an engine of the type mentioned is usually from 60 to 80 lbs., according to the ideas of the manufacturer. The ratio of compression is found from the formula

$$(p\ v)^{1.35} = (p.\ v.)^{1.35}$$

absolute pressures, of course, being used.

This formula gives the final volume into which the suction air is compressed and is the adiabatic ratio of the compression for stroke and clearance. If we subtract this from 1, we get the ratio for obtaining the clearance. This is done by dividing the stroke by the ratio, and subtracting the stroke. thus

$$\frac{\text{stroke}}{\text{ratio}} - \text{stroke} = \text{linear clearance}$$

This gives us

$$\left\{\frac{14.7}{84.7}\right\}^{1.35}$$

This must be worked by logarithms, and we get

log 14.7=1.167317
log 84.7=1.927883

T .239434

This must be multiplied by 1.35, the product being T .03323, the number corresponding to which is .108. Subtracting this from 1 we get .892, which is the ratio we want. Then

$$\frac{\text{stroke}}{\text{ratio}} - \text{stroke} = \frac{4.5}{.892} - 4.5 = .547 \text{ ins.}$$

The volumetric clearance will be

$25 \times .7854 \times 4.5 = \text{stroke vol.}$

$$\frac{\text{stroke volume}}{\text{ratio}} - \text{stroke volume}$$

which gives

$$\frac{88.375}{.892} - 88.375 = 10.675 \text{ cub. ins.}$$

The above shows the method of obtaining clearance. The amount of compression depends on the ideas of the designer.

COPPER-ALUMINUM-IRON BRONZE AS AN ACID-RESISTING ALLOY

By O. L. Kowalke

Copper-aluminum-iron bronze is known to possess many valuable qualities. In tensile strength it ranks with mild steel. It can be forged while hot, and also rolled into sheets; it can be machined to a nice finish, and sound castings can be made of it, free from shrinkage-holes and blowholes. These among other qualities render the alloy suitable for bearings and gear. But very little has hitherto been known concerning its acid-resisting properties. With a view to acquire knowledge in that direction, a systematic series of tests have been made at the University of Wisconsin laboratories. The results of these tests, which were made with various acids and alkalies, are set out for detailed comparison in three tables. Only two of the bronzes experimented with are reported on; they are distinguished as A and B. Their average compositions and properties were:

	Bronze A	Bronze B
Copper	87.0 %	85.6 %
Aluminium	9.8 %	10.81%
Iron alloy	3.14%	3.57%
Ultimate unit stress	74,800 lb. sq in.	66,600 lb. sq. in.
Reduction in area	19.0 %	13.0 %
Elongation in 2 in.	21.0 %	11.5 %
Specific gravity	7.71%	7.58%

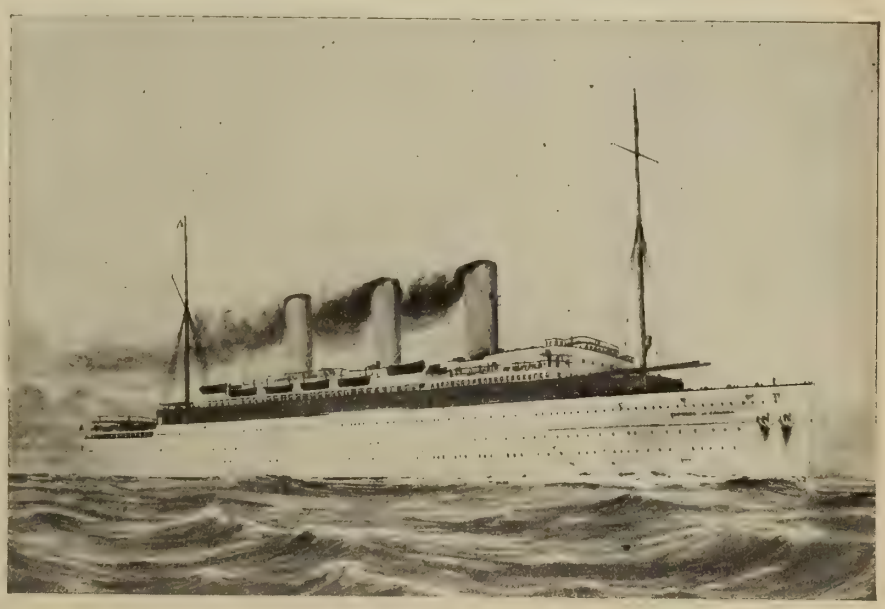
The specimens for the corrosion tests were approximately 1 in. by 0.07 in., and were finished smooth, with square edges. Most of the tests were made at room-temperatures of 72 deg. F. and 85 deg. F., but a few were made at 194 deg. F.

Bronze A was found to be resistant to several acids, particularly to sulphuric, lactic, phosphoric, tartaric, and acetic acids. Nitric acid attacked the metal readily, the concentrated acid acting violently. Hydrochloric acid and ammonia solution both attacked the metal too readily for commercial purposes. Caustic soda had but little effect. In the case of bronze B, a strikingly higher resistance to sulphuric acid is shown. Also ammonia did not corrode it so readily as bronze A. Nitric acid attacked bronze B also too readily; and hydrochloric acid attacked it more readily than bronze A. It is interesting to note that the corrosion, in 35 per cent. sulphuric acid, of a forged specimen of bronze A is only about half that of the rolled-sheet and cast forms.

VIEW FOR AEROPLANE PILOTS

A most ingenious invention is the "clear-view screen" which a British firm has produced for the benefit of navigators. Rain, spray, or snow renders it difficult or impossible to see through an ordinary port hole or other glass screen. The invention consists simply of a glass disc, which forms part of the screen and is rotated at so high a speed that any water or snow falling upon it is immediately spun off. The glass remains so clear that its rotation is extremely difficult to detect. This device has now been introduced on aeroplanes in order to assist the pilot when rain or snow encountered. The disc is driven either by a small windmill fixed on one of the struts, or by vanes fixed to the edges of the disc itself. When the aeroplane is travelling at 75 miles per hour the disc spins at 1,200 revolutions per minute. At anything over 800 revolutions the glass will keep clear in all weathers.

It is not generally known that the Panama Canal is dependent entirely upon the water from rains of the wet season which are gathered in the great storage reservoir of Gatun Lake. The canal was brought down to a narrow margin of supply by the unprecedented dry season just ended and official reports show that this was the dryest season since American occupation of the canal zone, and that the lake was reduced to within less than a yard of the point where there would not have been sufficient water for safe navigation. Only resort to steam power for operation of the canal mechanism during part of the season kept the water level up to the minimum point of 81.76, which was recorded on May 28th.



SS. EMPRESS OF CANADA.

PROGRESS IN NEW EQUIPMENT

There is Here Provided in Compact Form a Monthly Compendium of Shipbuilding and Marine Engineering Auxiliary Product Achievement

ELECTRIC RIVETING MACHINE

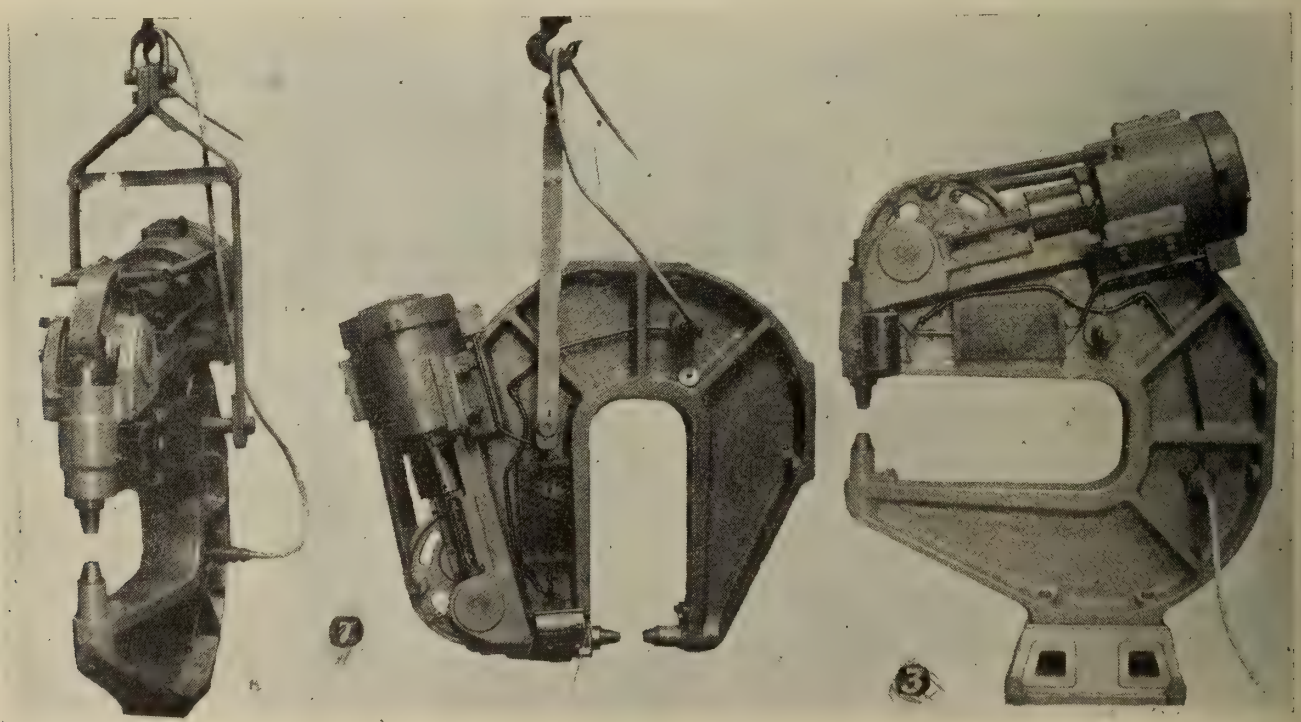
Many cases arise in practice in which it would be desirable to employ power riveting, but in which either the amount of work to be done, or the isolated situation of the work, is such that it becomes very questionable if the installation of an hydraulic or pneumatic plant is justifiable. Most large works have now either one, or both, of these forms of power available, but many small ones have neither, and in the large works it is unusual to find the distributing mains, for either pressure water or air, carried over the whole ground. These and other circumstances make the possibility of riveting by means of electric power a matter of considerable importance in many cases and add interest to the electric riveting machine which we illustrate herewith. There are but few shops nowadays in which a supply of electric power is not available, and the ease with which mains can be run to a new position should, in many cases, make an electric riveter an attractive proposition. Even where alternative forms of power are available, the supply mains cannot, as a rule, be extended with the facility with which a cable can be run. In exposed situations the cable also, of course, has advantage over an hydraulic main in eliminating the possibility of trouble owing to freezing.

The machine which we illustrate has been patented by Mr. Edward Adamson and is manufactured by the Mada Engineering Co., Ltd., of 12 Bevington Hill, Liverpool. The machine is known as the "Remca." Its general appearance is well shown in Figs. 1 to 3, from which it will be seen that it consists of a bow-frame with the operating mechanism carried on one arm. The machine may be used either vertically or horizontally, and may be suspended, as shown in Figs. 1 and 2, or fixed to a stand as shown in Fig. 3. The operating mechanism consists of a long-stroke solenoid designed so that full advantage is taken of the fact that increasing power is developed as the core approaches the end of its stroke. This gives a type of action particularly suitable for riveting, the final pressure being the maximum pressure. As will be seen from the figures, the whole arrangement buids up into a neat and compact tool, which, for portable work in particular, should be very convenient owing to the power being carried by quite a flexible connection.

The electrical connections of the riveter are of a simple nature. An earth wire is incorporated in the cable so that the frame of the machine may be earthed. The tool is, of course, operated by alternately closing and opening the switch and, if necessary, more than one operating point may be arranged for by fitting more than one switch. When a rivet is closed the pressure may, of course, be maintained while the rivet is partially cooling, simply by leaving the switch closed. Trials have shown that a ⅝-in. iron rivet may be closed by one of these machines with 16 amperes at 230 volts, the time from closing the switch to opening it being 3 secs. The riveters are made to deal with rivets from ¼ in. to 1¼ in. diam. and with various depths of gap.

STERILIZATION OF SOLUTIONS

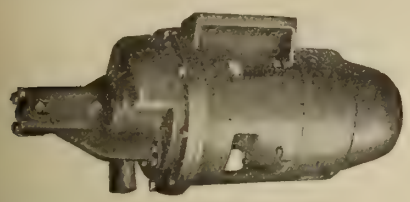
Many ideas have been tried out relative to the sterilization of cutting solutions, but the most successful one for the average industry, according to "Safety Engineering," is to have a set of drains running from the machine to a large pit consisting of two large tanks. The solution is run into one tank, which collects a great deal of the sediment, and then over to the other tank to be used again. Each week, and sometimes twice a week, the solution is taken out and the pit cleansed thoroughly. The solution is then returned to the pit, if it is not broken down, and is heated up to 148 deg. by steam pipes running through the pits, and maintained at that temperature for a half-hour. This process has been in successful operation at the plant of the Ford Motor Company. Examination with the microscope of the solution at the Ford plant showed from 10,000,000 to 15,000,000 bacteria per cubic centimetre in the infected solution, whereas but 400,000 to 600,000 bacteria per cubic centimetre appeared in the sterilized solution.



THESE THREE VIEWS GIVE A GOOD IDEA OF THE GENERAL APPEARANCE OF THE RIVETER.

SMALL TURBO GENERATOR SETS

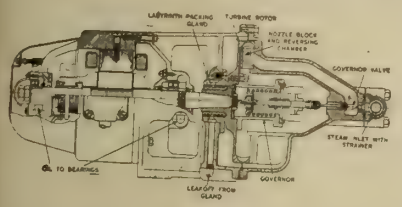
Although developed especially for supplying energy for locomotive headlights, the turbine-generator units just placed upon the market by the Westinghouse Electric & Manufacturing Company



may be used for lighting service in small isolated steam plants such as pumping stations, small steam shovels, oil well derricks and in other applications where a small amount of lighting is required. The construction is especially advantageous for portable application, as it is designed for severe outdoor service.

This unit is small, light and compact, requiring no foundations. It can be set up on a floor, heavy board or in any horizontal place and held in position with four small bolts, studs or lag screws.

While totally enclosed, all parts are readily accessible by removing the end cover on the generator and the turbine end casing on the steam end. There



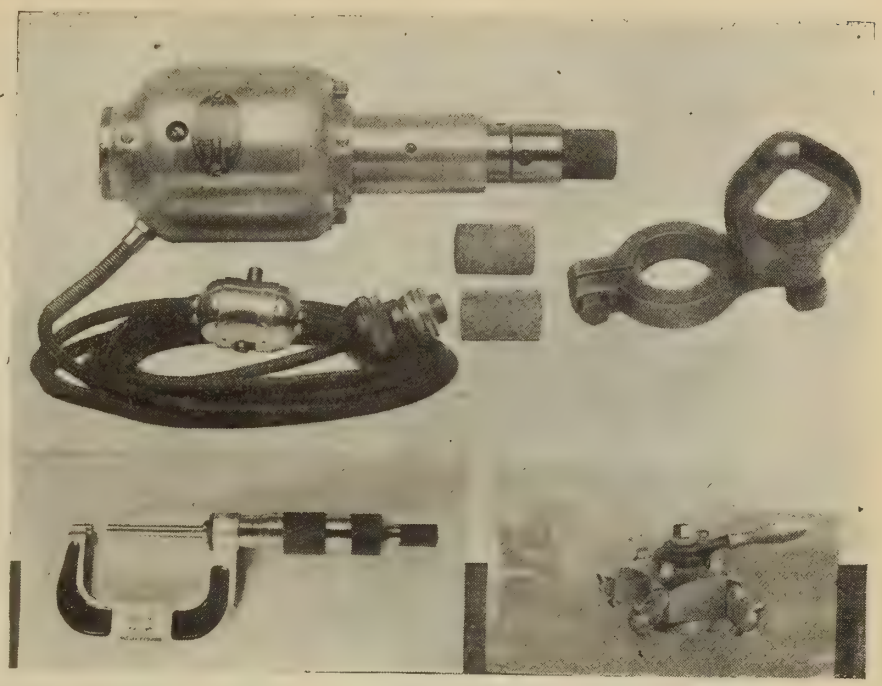
are only five moving parts—the shaft carrying the generator armature and the turbine rotor, two governor weights, governor spindle and governor steam valve stem—thus making for simplicity of operation.

As there are no levers to wear and stick and no packing to adjust and renew, no adjustments are necessary after the unit leaves the factory.

The unit is self-contained, each part being built for each other. The single shaft carrying the generator armature and turbine rotor with governor is supported by two standard self-aligning ball bearings at each end of the armature—the turbine rotor with governor being overhung.

The generator end consists of one casting containing one bearing and the field poles with windings. To this is bolted the middle section, which carries the second bearing and holds, by a web, half of the turbine rotor housing.

This middle section supports the whole unit. The steam space, governor valve and steam strainer are contained in the third or turbine casting. This construction eliminates all chance of temperature distortion, insures no leakage of steam to the generator, and gives a rugged perfectly balanced unit.



TOP VIEW SHOWS GRINDER, LOWER LEFT HAND VIEW THE MICROMETER, AND REMAINING VIEW THE TOOL POST.

BLUSH MULTIPLE MICROMETER

A. T. Blush Tool Co., 1145 West 11th St., Erie, Pa., have placed on the market the micrometer as illustrated. The purpose of the instrument shown is to eliminate the necessity of using two instruments in taking measurements ranging from 0-in. to 2-in. This is accomplished by the use of two threads of different pitches, namely, a 20 pitch for the measuring screw and a 40 pitch for the thimble carrier. Although the mechanism embodies two screws, the accuracy of the instrument depends only and entirely upon the 20 pitch thread as the 40 pitch thread only functions in keeping the thimble in proper alignment with the graduation on the hub.

The difference in the pitch of these threads makes it possible to obtain a 2 inch movement of the spindle with only a 1 inch movement of the thimble. The adjustment for wear on the anvil and the spindle is taken care of without moving either the anvil or the measuring nut which makes a very desirable feature as it is impossible to throw the anvil and the spindle out of parallel when making adjustments.

Due to the fact that the spindle is actuated with a 20 pitch thread this makes a very fast acting instrument as the thimble travels half as fast as the spindle. Another feature is the graduation, which is said to be much easier to read than the old style of graduation.

It is their intention to make these instruments in larger sizes having a range of 2 inches on each size, also a special instrument for very close work ranging from 0 inch to 1 1-2 and 1 1-2 to 3 inches.

PLANER IMPROVEMENTS

The Cincinnati Planer Co. have incorporated a number of changes in the design of their planers which add to the serviceability of the machine. The top arch is now being made of the box pattern, which gives increased strength and bearing surface on the housings. The cross-rail is likewise of the box type and it is claimed that increased rigidity is a feature when the tools are cutting. An automatic stop has been added to the machine so that the clutch for elevating the cross-rail may be released at any desired point in the vertical range. Improvement has also been made in the holding device for the tool post harp.

FLUE AND PIPE BENDER

The Baird Pneumatic Tool Co., Kansas City, have placed on the market an arch flue and pipe bender as shown in the accompanying illustration. This machine is especially adapted for bending into difficult shapes locomotive or marine arch flues, also air pipe connections as used under the regular freight or passenger cars.

It is rigidly constructed to meet the hard usage of boiler shops, and will bend arch flues or pipe to any desired angle. It is not necessary to sand or heat the flues or pipes with this machine.

It is fitted with special blocks and forming rollers the exact contour of the outside diameter of 3 in. and 2½ in. boiler tubes. It is said that the round bend obtained by using this machine permits a flue-cleaning motor to pass through in the cleaning process. This is very often necessary in cleaning arch flues.

As can be noted from the illustration the complete machine includes cast iron table with planed, finished top. To this

table is fastened the air cylinder supporting the piston directly connecting with the forming rollers and yoke, which in turn produce the radius bends in the pipe through the forming blocks and quadrant located at opposite ends of the

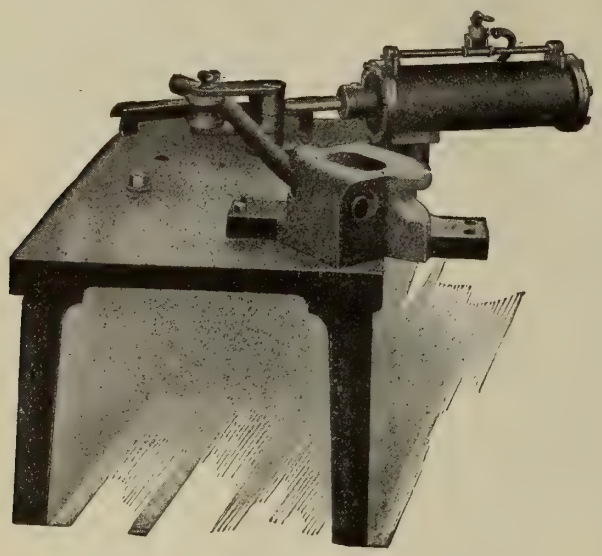


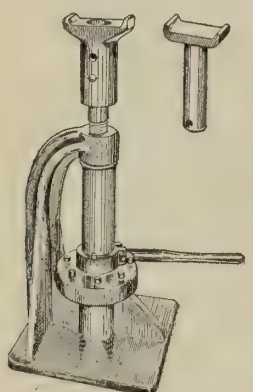
table. This quadrant is fitted with a plug which can be placed in spaced stops to secure any radius within the capacity of the machine.

A patented four-way valve is fastened to the cylinder and within easy reach of the operator. Should more than the bend required be secured, by reversing the air valve the operator can take out the amount necessary. This notice should particularly interest railroad shops, marine plants, boiler shops, and shipyards. Following are the machine's principal specifications.

Diameter of air cylinder; 3 in.; stroke of piston, 26 in.; maximum travel of forming roller, 26 in.; air pressure required, 100 pounds per square inch; dimensions of forming table, 3 ft. by 5 ft.; bending blocks — one with capacities, pipe, ¾ in., 1¼ in., 1½ in., 2 in., 2½ in. and 3 in.

REPAIR JACK

The R. S. Whitney Manufacturing Co., Lewiston, Me., have placed on the mar-



ket a safety repair jack which is illustrated herewith. This type of jack is designed to meet the demands of all classes of car, truck, and tractor repair work, and combines simplicity with strength.

All parts are properly proportioned, and a lever raises and lowers the screw, and is attached by means of a collar to the rotating nut. This, of course, increases the adaptability and flexibility of the jack. The rotating nut is placed at the extreme lower end of the screw in order to provide the greatest possible clearance. An extension supporting arm is also included, this portion being shown in the sketch. You can thus accomplish varied work with the one jack. The height closed is 19 inches, and it has a raising radius of 11 inches plus that of 7¼ inches, obtainable by using the extension arm, therefore the scope of usefulness and utility is practically unlimited.

ELECTRICALLY DRIVEN PUMPS.

At a meeting of the Institution of Water Engineers, held at Birmingham, Mr. C. F. Bekenn, A.M.Inst.C.E., contributed a paper on "The Application of Turbine-pumps to Water Supply." In the course of the paper the author remarked that while turbine-pumps could be driven by any type of prime mover, he placed the electric motor in the first place as regarded efficiency and convenience. The installation costs, including foundations, were low, and the space occupied was small. The pump and motor required very little attention, as the bearings were automatically lubricated with oil-rings. Low installation costs permitted the sets to be conveniently distributed. They were easily started up, and could also be operated from a distance or automatically stopped and started, either by varying levels in the reservoir or by varying pressures between pre-determined limits. The alternating-current motor was preferable to the direct-current machine owing to the absence of a commutator, and most of the installations at work were driven by A.C. motors. If a heavy current rush on starting was permissible, it was advisable to install squirrel-cage motors, as the turbine-pump, owing to its low-starting torque, could easily be started up by this type of motor. One point that had to be noted was that the slip between synchronous and asynchronous speeds could not be exactly determined, and might vary as much as 2 to 4%. The B.H.P. required to drive the turbine-pump varied as the cube of the speed, so that should the slip be less by, say, 2% than the makers' original estimate, the B.H.P. would be considerably increased, with a proportionate increase of water. For squirrel-cage motors, auto-transformer starters of the oil-immersed type should be installed, with no-volt and overload release on the three circuits, these operating in the stator circuit. The starter consisted of a transformer with tappings on the windings, of varying percentages of the line voltage. The tappings should be selected as best suitable for the starting torque, and as that was not more than 50% of full load torque, a low percentage, say, 25 or 30%, was sufficient. The automatic features were arranged in the "running" position only, because in the "starting" position they would at once break the circuit owing to the rush of current, which was generally two or three times the ordinary running current. This type of starter required only three terminals on the motor and six on the starter—namely, three for the motor and three for the line. In cases where low starting currents were necessary, slip-ring motors should be installed, as those would start up with 50 per cent. of full load torque using normal running current. With reference to motor terminals, trifurcating boxes were recommended as providing an extremely neat finish and effectively enclosing all the live parts. In large pumping-stations, where the current had to be carried some distance and the motor-power was at least 150B.H.P., the motors could be wound for 6,000 volts, and so dispense with transformers. For motors of less than 150B.H.P. a lower voltage was necessary on account of the difficulties of insulation in the coil windings.

Proceeding to discuss the relative costs of steam and electric pumps, the author gave several examples as showing that economy was on the side of the latter. Thus, the City of Hereford had three electrically driven pumps working off a three-phase, 50-cycle circuit, two sets delivering 60,000 gals. per hour, and the other set delivering 20,000 gals. per hour, against a total lift of 120 ft. in each case. The costs, as recently determined, showed that with electricity at 0.75d. per unit, the cost of electric pumping was 0.5d., as compared with 0.426d. per 100,000 gals., the cost of steam pumping. Those figures included men's wages, lubricating oil, waste, etc. The Newbury District Water Company, early in the year 1912, made careful tests of its compound condensing steam pumps, and of its electric pumps. The latter were driven by direct-current motors, one set having a capacity of 30,000 gals. per hour against 185 ft. lift, one set 20,000 gals. per hour against 150 ft. lift,

and a further set 3,000 gals. per hour against 164 ft. The 1912 costs worked out at 1.18d. per 100,000 ft.-gals. for steam, as against 0.957d. for electrically driven pumps, but for 1920 the figures are 2.61d. and 1.576d. respectively. The Chester Waterworks Co. had installed a Diesel engine and dynamo supplying power to drive turbine pumps built by Sulzer and the Rees Roturbo Company, at two separate stations connected by cable. The costs, including all transmission losses and "shut-downs" due to interruption in working consequent on erection of additional plant, came to 0.657d. per 1,000 gals. 100 ft.

LAUNCH OF THE "EMPRESS OF CANADA"

Some interesting information was given by Sir Thomas Fisher on the occasion of the launching of the Empress of Canada at the Govan yard of the Fairfield Shipbuilding Company. Sir Thomas is the general manager of the Canadian Pacific Ocean Services, Ltd., and the new vessel is the latest addition to the fine fleet of the C.P.O.S. Speaking about costs at the present time, Sir Thomas pointed out that the cost of the Empress of France would amount to about 1,700,000 pounds, or roughly eight and a half million dollars at the ordinary value of sterling. In contrast to this, the "Calgarian" built just before the war, and a somewhat similar ship to the Empress, cost only 550,000 pounds. This was a huge increase in capital cost, but maintenance and operating costs had gone up even more. The difference in insurance, depreciation, and interest on capital on the ship built in recent times compared to one built before the war meant an additional expense of about 20,000 pounds on a round voyage across the Atlantic and return. Not only this, but owing to the sacrifice of passenger accommodation to give more comfort to the crew, the ship's earnings were cut down about 5,000 pounds each voyage. The net result of all these factors was that a round voyage by the "Empress of Canada" would cost the company about 60,000 pounds more than a voyage by the "Calgarian" would have done in pre-war days. While fares had risen by 185 per cent. the cost of running the ship had gone up by 350 per cent., and Sir Thomas said that such a condition could not continue indefinitely. If costs kept going up in these proportions, it would tend to stop travel between different portions of the Empire, and would be an effectual check on emigration from the Motherland to the overseas Dominions. The remedy he thought was by standardization, and more combination among shipowners. Economies could be effected, by employing slower ships, and building the intermediate style of vessel that could carry a good cargo and a fair passenger list as well. In the case of a twenty knot vessel, if the speed was reduced by four knots, which would make the passage 24 hours longer, half the coal could be saved.

A WONDERFUL CHANGE-SPEED GEAR

Many inventors in all parts of the word have tried for years past to design a mechanical gear which would enable the speed of a machine to be varied smoothly and continuously within wide limits. The mechanical difficulties were indeed so great that engineers have generally decided that some electrical or hydraulic gear was necessary. Recently, however, a British inventor demonstrated that he had solved the problem successfully on mechanical lines. His device is as daring as it is simple and effective. In its simplest form it consists of two parallel shafts, each carrying a sprocket which is capable of being expanded or contracted in diameter. The wheels are connected by an endless chain. A control lever operates the mechanism of both wheels at the same time, so that as one gets larger the other gets smaller. An ingenious arrangement is introduced to keep the teeth always at the correct pitch of the chain so that the running is easy in all positions. The device has already been applied to driving machine tools, where a readily variable speed is of great advantage. It is also spoken of in connection with the driving of motor cars. A large British factory previously engaged on war work has been acquired for the manufacture of these gears.

GIANT FLOATING CRANE

A floating crane recently supplied from Great Britain to an Australian dockyard is one of the giant cranes of the world. It is capable of lifting a load of 150 tons and swinging it within a radius of 90 feet. In this British design the whole of the deadweight is carried on a large "roller path" fixed to the deck of the pontoon and not on the top of the steel tower which rises from the centre of the pontoon. Dangerous stresses are thus avoided, material is saved, and the life prolonged. The crane has been officially tested up to 200 tons with complete success, all the performances calculated for by the builders having been realized. No moving ballast is used in the pontoon, and at no time is the angle of tilt more than about four degrees. Two cranes of a similar type have been at work in the same dockyard for six years. A noteworthy feature of the crane is that, although designed for heavy loads, it handles light loads with ease and rapidity. All the machinery on board is electrically driven, power being obtained from a steam dynamo or from shore by means of a flexible cable.

BRITISH OIL ENGINE PIONEERS

The way in which a name, whether good, bad, or indifferent, sticks to a thing which has once received it is illustrated by the Diesel engine. In many vital respects the modern oil engine as used for propelling ships and for generating electricity is distinct from the type invented by the late Dr. Diesel, but people go on calling them "Diesels" as if the German inventor were the father of them all. There is a good deal in a name when applied to an engine in common use, because a wrong name not only gives a mistake notion of the machine but it does an injustice to the real inventor. This point came up at a recent meeting of the British Institution of Mechanical Engineers, when a paper on the progress of oil engines was read. It was there pointed out that the so-called Diesel engine was really the Ackroyd Stuart engine, as a British inventor of that name had, long before Diesel's day, worked out the principles on which large oil engines could be made to work satisfactorily. British engineers feel that it is the name of Ackroyd Stuart and not that of Diesel which should be immortalized in connection with this great branch of engineering.

AUTOMATIC WIRELESS OPERATION

The recent strike of wireless operators showed what serious results might flow from being obliged to rely upon highly skilled men for the working of apparatus now regarded as essential to the safety of ships at sea. The necessity of carrying operators is also an obstacle in the way of the adoption of wireless telegraphy on smaller vessels. Practical interest is therefore certain to be taken in any simplification of wireless operation. A British firm has recently produced what it describes as an "automatic" wireless transmitter. All that the user has to do in order to send certain signals is to pull down certain handles on the apparatus. The inner part of the device consists of a drum carrying electrical contacts which move over fingers, each one of which sends a special signal. With the aid of a small additional drum as many as 60 signals can be obtained. These signals can be coded in any desired way so that a large variety of messages can be sent. This instrument might be used by a pilot on an aeroplane to indicate his position, or by the skipper of a fishing vessel to signal information about his catch. The user need have no knowledge of wireless telegraphy or of the Morse alphabet. In connection with wireless progress it may be noted that wireless telephony is making such strides in Great Britain that a large news agency has agreed to experiment with it in the distribution of news from one point to a number of newspapers.

Close Welland Yard. — Another fortnight will see the yards of the British American Shipbuilding Company closed and the activities of one of Welland's foremost industries at an end. The finishing touches are now being put on the "Canadian Squatter," and in two weeks the sections will be towed to Montreal for completion. The plant will be sold and the buildings removed. At the present time only 150 hands are employed. At the first of the year the payroll carried 500 persons, and, at its peak, the yards had 500 employees. In all five vessels have been built, and for these over a million and a half dollars has been paid out locally in wages.

MARINE ENGINEERING

AND

Canadian Merchant Service Guild Review

A monthly journal dealing with the progress and development of Merchant and Naval Marine Engineering, Shipbuilding, the building of Harbors and Docks, and containing a record of the latest and best practice throughout the Sea-going World.

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Trade Follows the Flag

THE saying which is used as a caption for this article is not always true. In some cases, and perhaps the majority, the flag follows trade, and it is in this manner that the British Empire has been developed. The originators of the Canadian Government merchant marine, however, saw that the possession of a fleet of modern commerce carriers, which could go to all parts of the world, could become a great drawing power for Canadian trade, and that in this case trade would follow the flag. The Canadian Government fleet, conceived in the first instance as a measure to tide the shipbuilding yards over a doubtful period, has expanded into a ship-owning concern that will have no less than sixty-six first class modern cargo carriers under its flag. This flag is the flag of the Dominion of Canada, and it does not require a very great imagination to see what an advertisement for Canada this fleet can be. Sailing from Canadian Atlantic and Pacific ports, these Canadian built and Canadian manned steamers will carry holds full of goods manufactured in Canada to every port on the shores of the seven seas. This fleet would justify its existence were it as a great advertising scheme only, but it has already justified itself as a commercial success. The Canadian Government Merchant Marine is a fleet in being, of which every Canadian can be justly proud.

Can Anyone Prove It?

IN a newspaper report of a recent disaster on the Great Lakes, the statement is made that as the vessel was sinking, the boiler exploded. This is not an unusual statement, but we venture to say it has little but the reporter's imagination to back it up. Is there any good reason why a boiler should explode on a sinking ship? The thoughtless individual usually jumps to the hard-worked explanation of the sudden contraction and lets it go at that. What then does this sudden contraction perform? Does the shell contract so much that the pressure is increased beyond the resisting strength of the metal? Most assuredly not. The sudden contraction theory does not hold water. The fact is that the boilers do not explode when the ship is sinking. If they did, it would be of little use trying to salvage sunken steamers, as they would be damaged to such an extent that salvage would be impossible. Of all the steamers sunk by mine and torpedo during the war, were there any cases of boiler explosions unless the boiler shell was actually ruptured by a piece of shell, or other projectile? As a matter of fact, the boilers on steamers sunk and afterwards salvaged are usually found intact and fit for use again. This idea of the boilers on a sinking ship exploding is one that has been fostered by non-technical writers in the daily press, and accepted without question by men who should know better, and who would recognize the error of the statement if they gave the matter a little thought

The Pessimist Is Here

DID you ever meet the man who knows for certain that the bottom has dropped out of business? He gets you in a corner and pulls a paper out of his pocket, showing where some thousands of men have been laid off by a tire-making plant, where some other concern has laid off the night shift, and he has well pencil-marked all references to money being tight. There is always a danger of his not properly understanding what tight money means, failing entirely to realize that such a turn is a good business tonic for those houses that, if left to themselves, would never get their accounts in proper shape.

As a matter of fact it requires no ability to circulate pessimistic news; it is the easiest thing imaginable to pass it along, and any blatherskite can appear apparently well informed if he has rolled together a half dozen instances of this kind.

Take all the unfavorable circumstances, and add them together. Alongside them put the favorable ones, including the large orders still on the books of many of the industries, the splendid crops, the increasing efficiency of labor in many places, then weigh your results and see what you have.

It is much better, as far as possible, to do your own industrial survey work, rather than depend on others who have not had your point of view, and whose interests may sag while yours would prosper.

An automatic wireless call device was recently described by Major Basil Binyon before the Wireless Society of London. By means of an aerial which had been erected, Major Binyon was able to give a practical working demonstration of this novel piece of mechanism. Pre-arranged messages were received from the wireless station at Slough, and the selector mechanism proved beyond doubt that it would respond only to signals for which it was set to receive. By the use of this apparatus it is only necessary to employ one operator on board ship, since during the less busy hours of the day the automatic call device may be left to take incoming signals. On the receipt of a message giving the call signal of the ship in which it is installed, or the distress signal S.O.S., a relay is put in action, a bell rung, and the operator called to his instruments.

News of The Shipping World

THE controversy aroused by the passing of the Jones' Act in the United States goes merrily on. On the Pacific coast a movement has been started, the avowed aim of which is to defeat Senator Jones in the forthcoming elections who is a candidate for a third term. An organization under the name of the "Northwest Industrial Education Committee" is using full page advertising in the Seattle and Tacoma papers. This body and the opponents of the bill in general claim that the coming into force of the Jones' Act will destroy their trans-Pacific trade, which is carried in 90 per cent. foreign bottoms at present. The newspapers of the Atlantic coast, on the other hand, claim that the opposition on the Pacific coast is being engineered by Japanese and British shipowning interests, and hint at action soon to be taken by the U. S. Department of Justice to bring these aliens to book. What the action will be remains to be seen, though probably it will partake of the nature of a prosecution for lese majeste, or high treason. There is no doubt that the American people are vastly stirred over their new mercantile marine, and the fact that so few of them know anything about it makes it all the more interesting.

* * *

The United States Shipping Board is still offering about 12,000,000 tons of shipping of various kinds to the highest bidder, but so far there do not seem to be any kinds of bidders either high or low. Meanwhile the Shipping Board is more or less disorganized, and till the vacant places on the board are filled little is likely to be done. There seems to be a doubt as to whether a large number of the ships are commercially desirable or not, and to what trades they are suitable. A very large number of them are of sizes that make them undesirable for any but the coasting trade. Meanwhile there is much idle tonnage.

* * *

Ships coming to load and discharge in New York are subjected to endless delays, and the congestion there is still very bad, due to the strikes of various kinds which are going on. An American steamer coming from South Africa recently could not get a berth at any of the regular unloading wharves, and had to be sent to the army base at Brooklyn, and the luckless passengers were left to find their way to New York as best they might. The army base at Brooklyn is situated at 59th Street, and anyone knowing the place can imagine the experiences of passengers with the usual amount of baggage getting it transported to the New York depots.

* * *

Judgment was delivered some time ago in the Privy Council on an appeal against a judgment of the prize court, and the circumstances are of rather unusual interest. The appeal was taken by the American Trans-Atlantic Company against a judgment given by Sir Samuel Evans, in which he condemned three vessels as lawful prizes. These vessels were the "Kankakee," "Hocking" and "Genesee," which were seized about October, 1915, by the British authorities. The appeal of the shipowners was based on the grounds that the ships were American ships, flying the American flag, and were therefore not to be classed as enemy property. However, the Crown held that although the vessels were flying the American flag they were to all intents and purposes owned by a German, and the German was no less a person than the redoubtable Hugo Stinnes, about whom so much has been heard recently. It appears that soon after the outbreak of the war Stinnes deposited in Copenhagen a sum of 50,000,000 kronen, to the credit of a certain Albert Jensen of that city, and with this money Jensen bought ships. He was interrupted in this business by the fact that he was sent to prison for having exported copper to Germany against the laws of his own country. However, a man named Theodore Lahr took up the work, and went on with the purchasing. Altogether there were 11 ships purchased, among them being the three mentioned in this case. A third man came into the case in the person of R. G. Wagner, of Milwaukee, who visited Denmark in 1914 and entered into an agreement with Jensen under which Wagner was to form a company in the United States and purchase the ships from Jensen. This company was the American Trans-Atlantic Company, and the ships purchased were those bought by the money furnished by Hugo Stinnes. It was sought to prove that Jensen bought the ships with money raised by himself personally, only a small portion of it coming through Stinnes. The company, although it had an office in Copenhagen and the ships were purchased by Lahr and Jensen, both Danish subjects, never attempted to register its vessels in Denmark, and after Jensen's conviction Wagner wrote him a letter in which he expressed the intention of eliminating Jensen from the company. This could hardly have been possible if Jensen had been a principal in the concern. It was obvious to the court that the real man behind the company was Hugo Stinnes, and in that case it upheld the decision of the prize court, and the appeal was dismissed.

* * *

Leading men in the shipping world continue to deprecate the ever rising cost of shipbuilding and ship operating, which they say will bring disaster if not soon put a stop to. The latest demand from some of the seagoing staff for an eight-hour day and more wages is an instance of the way costs are piling up. Sir Frederick Lewis, the chairman of Furness Withy Co., points out that the granting of this demand, in the case of an 8,000 ton cargo steamer, would mean an increase in personnel of 14 members, from 54 to 68. The extra cost of wages and victualling would amount to £8,000 per annum, and the capital cost involved would be £3,500 to provide additional quarters and lifeboat accommodation. The bunker coal situation is still bad, and results in ships being tied up for days when they should be on their voyages. Worse even than this is the fact that instead of exporting 78,000,000 tons of coal per annum Great Britain is only exporting one quarter of that amount. This means that ships have to perform their outward voyages light, and this has to be made up by higher freight charges on the homeward voyage. Dock dues and unloading charges are getting to a point where they are fast becoming unbearable, and one case is quoted where a steamship company had to pay 78½ per cent. of the gross freight it received to get the ship discharged in Newcastle. The situation in the shipbuilding business may be seen from the fact that shipowners who have placed orders some time back are paying huge sums to cancel their contracts. These amounted to as much as £50,000 in one case. No new orders are being placed, and the outlook is for a very bad time in the next few months if conditions do not change. The mad scramble for wages has produced its own Nemesis, and it is highly probable that circumstances would dictate a recession from their present position on the part of labor.

* * *

The Freight Market

During the month there has been some improvement in the freight rates, and time chartering rates have shown

a better tendency. The coal carrying trade has remained dull, owing to the uncertainty as to the action of the British miners, but rates from the U. S. have shown a bit better. There was some fear that the United States Shipping Board would put a large amount of tonnage on this market if rates increased, thus having the effect of sending them down again with a bump. Freights from the west coast of India have improved, possibly in the hopes of a speedy lifting of the embargo on Indian wheat. Tonnage is being sought for timber from Japan to the United Kingdom, the rate offered being from 130s. to 140s., while wheat or beans from Valdivostock or Dalny to U.K. will pay 115s. to 120s. There has been a development of firmness in the River Plate market, as was foreshadowed in our last month's report, 95s. having been offered to U.K., with 105s. option Genoa. There have been fixtures on time charters at better rates, 12s. 6d. having been paid for a British steamer for six months, while a Japanese steamer has been offered 15s. on a foreign account. For a steamer 12 months general trading delivery U.K., 13s. has been paid, while the same amount is offered for Eastern trading six to nine months with delivery in the East.

* * *

Fixtures from the River Plate to United Kingdom for September and October loading have been made at 87s. 6d. to 90s. heavy grain, and 92s. 6d. linseed. From Bahia or Rio Janeiro to United States northern parts the rate is $8.50. From northern American and Canadian ports there is not much difference in rates. There has been a fairly brisk business done from the usual northern range ports of the U.S. to the Continent with coal. Some of the prices were as follows: Denmark and Scandinavian ports, $15; Antwerp or Rotterdam, $12, while French Atlantic ports are quoted $13. Grain from northern U. S. ports has been done at 12s. 6d. per quarter to Genoa. From Miramichi to U.K. ports, 170s. per standard has been done, while for flour the rate quoted from Montreal to a Greek port is 70s., with an extra 5s. for option discharge at two ports. Northern Pacific ports to U.K. for wheat or flour, $20 Sept. to Nov. loading, with $22.50 to Mediterranean, and $21 Continent.

* * *

From U.K. coaling ports to Port Said 28s., 27s. 6d. to Alexandria, and 37s. 6d. Casablanca has been fixed. From Tyne to Mediterranean ports 25s. to 27s 6d., with the same rate from Glasgow to west coast of Italy. A cargo of salt from Port Said to Rangoon has been fixed at 22s.

* * *

In the Far East trade rates are about what prevailed last month. Rice from Saigon to north France or Baltic is 115s. to 120s. Sugar from Java ports to Trieste, 110s. South African coal to Rio Janeiro, 75s. Wheat from Australia to U.K. or Continent is 125s., while jarrah wood West Australia to London has been done at 220s., with option Glasgow at 230s.

* * *

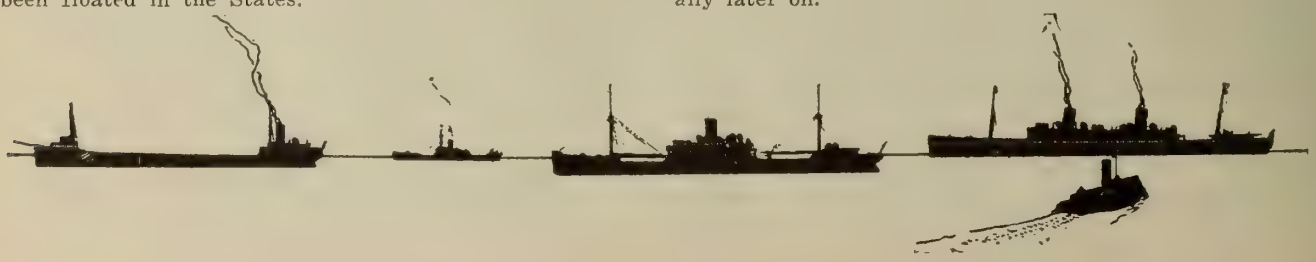
Another Salvage Company

A company has been formed in the United States to raise sunken vessels from the English Channel. The following comment on the company, which appeared in the columns of Syren and Shipping, is well worth reading, both for the amusement to be derived from it and also as an example of the view taken by a leading shipping paper on these numerous salvage companies which have been floated in the States.

"British salvage companies must look to their laurels —and their pickings—for we notice that their work has attracted the attention of would-be salvors in the United States, and, as imitation is the sincerest form of flattery, a big company has been formed for the purpose of "raising ships sunk by the German naval forces in the English Channel and elsewhere, and for the recovery of sunken treasure." The undertaking is labelled with the somewhat gradiloquent title of the Transcontinental Wrecking Company, and it is stated to have been formed at Washington with a capital of one million dollars. This scheme is said to be supported by 'intelligent business men,' whose methods of operation will be directed by skilled engineers. Through special devices, the company claims it can raise any ship that can be located at any depth, and this without sending a man beneath the surface. These 'intelligent business men,' have somehow or other learned that 'literally hundreds of ships sunk by German submarines strew the floor of the English Channel. Their cargoes in instances are still valuable, despite long exposure to water and sand and seaweed. The majority repose in water not deeper than 100 feet, and herein lies the value of the new scheme, for heretofore it has been impossible to devise any sure plan to raise vessels which lie in more than 50 feet of water. In fact, at greater depths the pressure of the water has been so great that few divers have been able to work.' When a wreck has been located the 'skilled engineers' will come in with tugs and submarine tower barges, equipped with powerful searchlights, grappling hooks, cranes, tubes, and other devices which form the principal instruments with which the company proposes to achieve success. Then there are two huge barges, especially constructed and wedged together, which will be brought directly over the wreck and filled with water and sunk so that the treasure ship lies directly between. Tugs overhead will then pump the water from the barges, to which the wreck has been fastened, and, relieved of their weight of water, they float to the surface! What the British companies will do when these intelligent and skilled Americans show them 'how to do it,' we do not know. But we do not think they need worry much. We have heard too much already of these American salvage cranks to be scared by a company which is after 'sunken treasure,' especially when, as is stated, it will make 'a definite attempt to raise the Lusitania.'"

* * *

Speaking of salvage reminds us of the late Captain Batchelor, one of the leading salvage officers of the Liverpool Salvage Association, who died recently. Captain Batchelor was in charge of the salvage operations on the "Rhone," a French steamer stranded on the west coast of Africa, and was successful in floating her and bringing her safely to Havre. As she approached the dock wall in Havre, a wildly excited French gentleman was observed who waved his arms and shouted himself hoarse. When the ship was tied up Captain Batchelor went on the wharf to see what ailed the gentleman, and was horrified by being suddenly embraced and given two resounding kisses, one on each cheek. Captain Batchelor was a big man, but he said that he never felt so absolutely helpless and ridiculous in his life as he did at that moment. The gentleman who bestowed the kisses was one of the interested underwriters and was only expressing his delight and gratitude to Captain Batchelor for his success in the salvage operations. In justice to him, it must be recorded that he expressed them more substantially later on.



Enquiries Into Marine Disasters

RE SS. "MANCHESTER DIVISION"—"TUNISIAN" COLLISION

IN the matter of a formal investigation held in the Wreck Commissioner's Court, Montreal, P.Q., on August 19, 20, and 24, 1920, before Captain L. A. Demers, Dominion Wreck Commissioner, assisted by Captain J. B. Henry and Captain M. H. Robertson, acting as nautical assessors, into the causes which led to the collision between the SS. "Manchester Division" and SS. "Tunisian" near Herin Shoal, River St. Lawrence, on August 14, 1920, whilst the former vessel was at anchor.

Honorable A. W. Atwater, K.C., and Mr. Errol M. McDougall appeared on behalf of the SS. "Manchester Division," and Mr. A. R. Holden, K.C., for the SS. "Tunisian."

REPORT

"Manchester Division"

The summary of the evidence of the "Manchester Division" causes the court to opine that the ringing of the bell, which is the most, and only important factor in this matter, was duly done.

It is inconceivable that after sending a wireless to the SS. "Tunisian," which was astern of her, coming in the same direction, that she was to anchor, the ringing of the bell when the "Manchester Division" came to anchor was omitted, or neglected, and this especially when the witnesses are unanimous in stating that they heard plainly the fog whistle of the "Tunisian."

The pilot, master and second officer positively stated that they were on deck before and at the time of the collision, the second officer having been on deck constantly from 2.50 p.m., the time of anchoring.

The bell was found, upon examination by the court, to be an efficient one, placed in such a position as to preclude the possibility of its sound being obstructed or intercepted by any obstacle in its vicinity. The court easily understands that though the man on the look-out, Leonard Kenyon, may have known how to strike the bell, that the chief officer, not being satisfied with the effect, should have given some instructions in order to render the sound more effective. Whether the bell was struck on one side or both, if done rapidly and frequently, would be as efficient; but the first officer evidently thought otherwise, which was his prerogative, and indicated and showed how, to his mind, the bell should be rung.

There is nothing in the evidence of the "Manchester Division" to cause the court to think that there was any neglect with regard to the bell.

When the collision appeared inevitable, prompt and commendable action was taken to minimize the contact. It was excellent seamanship to have succeeded in such a short interval in letting the chain run out and using the engines jointly. If this clear, prompt, and well-thought of action and decision had been omitted, it is difficult to say what would have been the results as regards the SS. "Tunisian" with her human freight. This prompt action is corroborated by the witnesses of the "Tunisian."

It is a well known fact that objects seen through a fog are distorted to a great extent. This brings the court to reflect that the evidence of the "Manchester Division," with respect to the foam created by the "Tunisian" appeared to the crew of the "Manchester Division" as being voluminous, was due to a magnifying process of the dense fog then existing.

The distance at which both ships were seen, unanimously corroborated as to being 600 feet distant, precludes the acceptance of that part of the "Manchester Division" testimony that the "Tunisian" appeared to have gone to starboard, then to port when the collision occurred. Such evolutions are impossible at such a distance, which also, in this case, was magnified due to the fog and the apprehension of disaster which must necessarily have arisen in any witness' mind.

Exhibits showing the position of each ship, by drawings, when first seen and at the moment of impact, differ materially, yet go to show that a movement to starboard under a port helm followed by a starboard helm and cant to port was impossible in such a distance as stated.

The question of interval was closely inquired into but the court must waive aside somewhat the testimony with regard to the time being 1½ to 2 minutes when the ships came in sight of each other, and conclude that the interval was much shorter.

The evidence with regard to strength of wind is contradictory, but as to its direction all witnesses agree.

A great deal of stress was laid in the course of examination with regard to the wireless message from the "Manchester Division" to the "Tunisian" which stated that the "Manchester Division" intended to anchor north of Morin Shoal, whereas when fog cleared away she was found to be to the south-west.

No doubt the intention of the pilot and master was to act as stated in this message, but with the fog which both ships had met, and tides affecting them, it was next to impossible to give absolutely a position, especially anchoring in such a restricted vicinity as the Morin Shoal, hence the Court is of opinion the message was sent in good faith and without intent of misleading, even if, after the message was sent, it occurred to the pilot or master to change their minds as to the anchoring position, providing it was not done in prohibited ground. It was their privilege.

Whilst the court thinks that in such circumstances it would have been wise to send another message as to the alteration of place, in this instance this could not be expected as both pilot and master were in doubt as to their actual position with regard to Morin Shoal. They came to anchor and did what the court is of opinion complied with the regulations concerning ships at anchor.

In common law a collision between a ship under weigh and a ship at anchor raises presumption of negligence on the ship under weigh, unless rebutted by proof of negligence on the ship at anchor.

The evidence as analyzed by the court fails to show any negligence by the crew of the "Manchester Division."

"Tunisian"

In analyzing the evidence of the crew of the "Tunisian" which is without contradiction, the court has to face and decide upon one important question, that of the interval of time the ships were in sight of each other before the collision.

If the 1½ to 2 minute interval were to be accepted as very precise, the court in arriving at a conclusion would be simplified, but having given to the "Manchester Division" the benefit of the doubt with regard to this matter due to the magnifying agency of fog, also to apprehension which doubles the length and duration of seconds, must likewise deal with the "Tunisian."

The speed was three knots, which was moderate and in accordance with Article 16, with a 2½ knot flood onward. If the ships were seen at 600 feet distance from each other is it impossible that 1½ to 2 minutes elapsed before the casualty.

The "Manchester Division" was seen half a point on the starboard bow at 600 feet distant. The ship at that time at the speed given, including tide, was covering the ground at the rate of 657 feet per minute. This is without considering the influence of the wind, the strength of which there is a divergence of opinion on, but which has been quoted as being force 5, and if so would add a fraction of a mile to the speed of the vessel per hour, likewise to the tide.

In view of so short an interval it is impossible that the "Tunisian" could have evoluted, no matter how slightly to starboard, then to port, as stated by the "Manchester Division" witnesses.

Can the idea of agony of the moment be invoked? In order to pass judgment on the wisdom, or lack of wisdom on the part of the pilot and master in starboarding to a vessel seen half a point on the starboard bow, there is one evidence to consider, that of Hurley, the look-out man, who said that with the megaphone he reported a ship, then a ship at anchor. That report from the look-out man was not mentioned by the

bridge witnesses in their evidence, but on the contrary they stated no report was made from the forecastle head.

Half speed on port engine, with a hard to starboard helm, then full speed on port engine, is the evidence of the pilot. The engineer says he had a "full speed" order. This was a proper action, meaning full speed, but it should have been jointly with a full speed ahead on starboard engine in order to turn the vessel quickly and help the starboard helm, but hardly was this accomplished than the master ordered full speed astern on both engines and helm amidships, the collision occurring almost simultaneously.

The above excerpts do indicate forcibly that both distance and interval mentioned by witnesses of each ship when each vessel apeared in sight of each other is much less than stated and for reasons already stated by the court.

The master at first sight realized that the ship seen was at anchor. Then the action taken owing to their respective positions, the "Manchester Division" being half a point on the starboard bow, may be accepted as correct, or rather permissible, but incomplete, incomplete in this sense, that a full speed ahead on starboard engine should have been given simultaneously with the other orders.

If it had not been determined whether the ship was at anchor or under weigh, a full speed astern on both engines, with corresponding signals by the whistle was a necessary manoeuvre, but if it was thought that the ship seen was under weigh, then a hard to port order, with corresponding orders with respect to engine was necessary in compliance with Article 18.

Since the court has quoted the "agony of the moment" as a point to be considered, it is at this stage timely to show that the conjectures of the court are correct, that the interval cited in evidence is exaggerated, not voluntarily, but in good faith, that the evolutions from the time the ships were sighted to the time of collision were almost simultaneous; that the distance was no greater than 600 feet, perhaps less, and that in that short interval of time, which can be safely reckoned in seconds, it was impossible for those directing the course of the "Tunisian" to reflect, think and determine maturely, therefore they acted on the impulse of the moment, having in view the respective positions of the ships, but the pilot omitted to complete the order to hasten the evolution in contemplation. Hence, the master, determining the inevitable danger, ordered full speed astern, a right manoeuvre under the circumstances.

The bell was not heard excepting by Hurley, the look-out man, when the collision was about to happen.

While the bell of the "Manchester Division" is of sufficient caliber and properly situated to emit a sound which could be heard at a sufficient distance to enable an oncoming vessel to take such course as to keep clear of the vessel giving such warning, yet it is a well known fact that sound in fog is replete with vagaries; combined with a breeze blowing against the sound, with the frequent blowing of the fog whistle by the "Tunisian," to which all witnesses testified had taken place, it is not to be wondered that the bell was not heard.

Counsel for the "Manchester Division" quoted that the "Manchester Division's" bell was heard twenty minutes before the casualty. The master admits having heard a bell at that time, on his port bow, but as he steered a straight course for twenty minutes, the bell heard could not have been the "Manchester Division," so that the second part of Article 16 is inapplicable.

The court is therefore of opinion that the evidence in that respect is truthful, likewise the evidence of the "Manchester Division" with regard to the ringing of the bell.

It does appear to the court that the moment the "Manchester Division" came in sight, half a point on the starboard bow, or nearly ahead, that a hard to port helm, and full steam astern on starboard engine would have been a proper order, owing to the direction of the tide. The pilot partially admitted that fact. He therefore erred in judgment in giving the order he stated, which the master immediately countermanded by full speed astern on both engines, and helm amidships, but they are uncertain whether the three basts were given. There was no alteration in the position of the "Tunisian" through the pilot's order, but there was loss of a few seconds.

Article 18 has reference only to ships under weigh. When one is at anchor there are no regulations which prevent the ship underweigh crossing the bow of the anchored ship, or passing on either side. The ship under weigh must be guided by conditions and relative position.

Article 23 was complied with.

Article 26 was not complied with, but the court does not attach any importance to the non-sounding of the three-blast signal. It was not necessary, and did not contribute to the collision.

Article 29 had been complied with by both ships.

In criticising the pilot's order the court is basing itself on the fact that on the course they were steering the influence of the flood tide was felt slightly on the port quarter, and by starboarding it brought the greater part of the "Tunisian" against the influence of the current.

The court being of opinion that it has analyzed thoroughly the esesntial factors which led to this casualty renders the following finding.

Finding

The court having most carefully reviewed and weighed the evidence adduced, finds, for the reasons given in the report, that the SS. "Manchester Division" cannot be held to blame for the collision, but on the contrary commends the master, Philip Linton, for his prompt action in slacking out the cable, which allowed his ship to give way at the time of the impact, thereby reducing the shock. This very action impresses the court most forcibly that both master and officers were on the alert.

The court holds and finds that Pilot Auguste Senterre, of the SS. "Tunisian," committed an excusable error of judgment in not completing the order he gave, but as stated before, that order being at once countermanded by the master, the ship did not have time to evolute on the first order. He is therefore cautioned.

The court is of opinion that the order "full speed astern," given by Captain C. W. Hodder, was the only possible command in such a situation, and in such a short space of time, and therefore concludes that the collision was inevitable.

The court suggests that whilst a proper look-out was kept, meeting the requirements of the "Rules of the Road," Article 29, perhaps a man in the crow's nest with one on the forecastle deck would have been more effective. However, no fault is found for the two men being in the bows.

The court will cite Marsden, page 6, defining "inevitable accident" as understood in Admiralty, as being "a collision which occurs without negligence in either ship and which could not be prevented by ordinary care or skill."

Ordinary skill, care and prudence were observed by both the "Manchester Division" and the "Tunisian."

Read in open court at Ottawa this 26th day of August, 1920.

(Signed) L. A. Demers,
Dominion Wreck Commissioner.

Concurred in by
(Signed) J. Blanchard Henry,
(Signed) M. H. Robertson,
Assessors.

RE S.S. "METAGAMA" STRANDING

In the matter of a formal investigation held in Montreal, P.Q., on September 16th, 1920, before Captain L. A. Demers, F.R.S.A., Dominion Wreck Commissioner, assisted by Captain J. Blanchard Henry and Captain C. J. Stuart, acting as nautical assessors, into the causes which led to the stranding of the S. S. "Metagama," at a place in the Contrecoeur Traverse, River St. Lawrence, whilst passing the S. S. "Wisley" at anchor, on September 12th, 1920.

Mr. A. R. Holden, K.C., represented the Canadian Pacific Ocean Services.

Mr. A. C. Barnard, K.C., appeared on behalf of the Canada Steamship Lines, Limited.

Captain J. B. Turnbull, of the S. S. "Metagama," deposed that his vessel was 12,420 tons gross, 7,654 tons net, length 520 feet, beam 64 feet, drawing 20 feet, 8 inches forward and 22 feet, 9 inches aft, of steel construction, with twin screws, capable of a speed of 14½ knots, carrying a crew of 350, including five certificated deck officers and twenty engineers, owned by the Canadian Pacific Ocean Services and registered in London, and was then on a voyage from Liverpool for Montreal.

Captain T. S. Bowen, of the S. S. "Wisley," stated his vessel was 4,399 tons gross, 2,717 tons net, length 380

feet, beam 49 feet, single screw, with a speed of 9 knots.

Captain Turnbull, Captain Brown, Pilot J. B. Anger and Wilbrod Gauthier were examined.

Report

The analysis of the evidence is to the effect that the "Metagama" on her way up the river was experiencing some rain showers which permitted lights to be seen at no further than two miles, when the anchor lights of a vessel were seen, the stern one opened to the north slightly, about 45 degrees. The master aud pilot were on the bridge, also the chief and extra second officers. The vessel anchored being thought to be in the centre of the channel Pilot Gauthier directed the course to be altered so as to pass to the north, right hand side of the channel, and under the stern of the vessel, reducing speed to half; but the "Metagama" had hardy passed half the stern of the "Wisley" when she grounded, and whilst going full speed astern drew the stern of the "Wisley" towards her, whereby slight damage was incurred by the "Metagama."

Under the circumstances it was natural for the pilot to assume that, in view of the strong east wind blowing, the vessel at anchor would possibly stretch her cable, thereby making the crossing of her bows hazardous, though it is evident that there was more room on the south side, in view of which and the first thought of an experienced pilot to pass astern, occurred and was followed up with the resulting grounding. The pilot admitted that there was more room had he selected to cross the bows; but his fear to foul the cable with his propellor is excusable. Hence attempting to pass astern cannot be held against him as a fault, but as an excusable error of judgment.

S. S. "Wisley"

The question arises as to whether Pilot Angers was justified in anchoring in the Contrecoeur Traverse in such a narrow channel. It is possible that pilots may differ as to the conditions of the weather, whether it permits them to safely steer their vessels. In this case, after consultation with the master, Captain Bowen, it was decided to anchor as the range lights could not be seen distinctly and sufficiently to permit them, with a degree of safety, to keep under weigh and they agreed to anchor at the spot indicated, some 2,000 feet from buoy 76 M, and to all intents and purposes in the centre of the channel, which was at least 800 feet wide where she anchored.

This causes the court to decide that as there are no regulations which forbid vessels to anchor at such a place, there being sufficient room to pass clear, the "Wisley" cannot be held in default for being anchored at that place; her stern being over to the north afforded ample room to pass to the south, which boundary line of safe water is more regular than to the north.

Whether the pilot and master of the S. S. "Wisley" were making the best of the situation is a matter which does not rest with the court to decide or criticize. If the "Metagama" choose to proceed under such climatic conditions, which evidently was not such as to prohibit those in charge of vessels to navigate her, is purely a matter of opinion, the responsibility resting with the interested parties. This applies equally to the master and pilot of the "Wisley." However, whatever may have been the reasons for one proceeding and the other to be anchored, the fact remains that the "Wisley" cannot be held to blame for anchoring at such a place, nor can she be held in default for whatever slight damage the "Metagama" incurred. Hence the following finding:

Finding

The court, having carefully weighed the very straightforward evidence given by all witnesses, finds that Pilot Wilbred Gauthier, in passing astern of the "Wisley" followed the natural impulse, and ordinary usage of taking his right hand side of the channel, and moreover, avoiding crossing the bow of an anchored vessel when there was a possibility of fouling her cable, hence, failing to recognize in time that he was taking the more limited space, is considered by the court as an excusable error of judgment.

The master of the "Metagama," Captain Turnbull, and his officers on duty are exonerated absolutely from all blame.

Pilot J. B. Angers and Captain T. S. Bowen, and officers, are held blameless. The court cannot criticize their action in anchoring at that place, but still recommend to all pilots that, whenever possible, they should anchor in such a place or spot where the passing ships will be free from any apprehension to which side would be best for them to select.

The evidence points to the fact that all lights and aids to navigation were in order.

Read in open court at Ottawa this 18th day of September, 1920.

Signed, L. A. Demers, Dominion Wreck Commissioner.

We concur

Signed, J. Blanchard Henry,
Signed, C. J. Stuart,
Assessors.

RE STRANDING AMERICAN COAST GUARD LIGHT CRUISER "TUSCARORA"

In the matter of an investigation held at Quebec, September 7th, 1920, before Captain L. S. Demers, F.R.A.S., Dominion Wreck Commissioner, assisted by Captain Charles Lapierre and Captain J. Couette, acting as Nautical Assessors, into the causes which led to the stranding of the American Coastguard Light Cruiser "Tuscarora," on White Island Reef, River St. Lawrence, on August 31st, 1920, whilst having in tow two tugs.

Reports

By the evidence adduced and statements made by Captain Eugene Blake, Jr., it shows that up to the time the ship came abeam of White Island Lightship, at about 1 or 1½ miles, the piloting and navigation were carefully executed.

The objection made by the Captain to the pilot's suggestion to another was theoretically correct, as anchoring off Isle aux Basques when a gale is blowing ing from the N N E, at a velocity, it is said, of 40 miles, with accompanying sea, did not appear as very safe, especially to a stranger, after having glanced at the chart and seeing how exposed that anchoring ground would have been. As the pilot did not insist upon it, but accepted the captain's suggestion to try and proceed on, hence the objection of the captain cannot be held against him.

That there was sufficient power to stem the tide is proved by the fact that the "Tuscarora" reached White Island, though slowly, stemming a tide which is said to have been running at 6½ miles an hour, but which the court really believes was less rapid, as the easterly winds had been blowing for a lengthy period, over a day's duration, which must necessarily have diminished the usual running of the ebb.

When navigation lights were all visible, the navigating officer having retired some three-quarters of an hour before the grounding, the captain, on the assurance of the pilot that everything was all right, withdrew and left the bridge in charge of a Warrant Officer, the Gunner, Olen Olsen.

It does appear to the court that, using Captain Blake's words, there was relaxation somewhere, that such condition was created through the absence of an officer versed in navigational and seamanship methods; bearings were not taken and position plotted frequently as had been prior to reaching White Island Lightship.

The court was not at all impressed with the ability of Gunner Olen Olsen as a navigator. He had taken the wheel and said he was paying attention to the steering.

The "Tuscarora" was being propelled at full speed by telegraph; but at reduced speed as by verbal orders, which was 115 revolutions, whereas her full speed demands 135 to 140 revolutions. Of this the pilot was unaware.

It does seem to the court that, facing a strong ebb tide, being spring tides, whilst towing two tugs, though those tugs were under steam, and helped the towing, that it behove the master to advise the pilot of the fact that more pressure and more revolutions could be obtained if necessary. However, as the vessel with her tow was making 2½ knots over the ground, and had steerage

way, it is not considered to have led directly to the grounding.

The method, rules and discipline in vogue in the American Vessels of War are not known to the court; but it is positive on one point, that the bridge should not be left in sole charge of the pilot.

Captain Blake, Jr., perfectly understood the pilot's role as adviser. Such being accepted, there must be someone near by to advise, or confer with.

Pilot

The evidence of Pilot Ernest Pouliet with respect to the suggestion of anchoring the ship and tow in order to await the flood tide, to which Captain Blake, Jr., disagreed momentarily, will not be further discussed.

Pouliet's actions up to the time of shaping a course for Cape Salmon were satisfactory; but when he shaped a course, bringing Cape Doge on his starboard bow before he had reached such position north of White Island, he forgot to take into consideration the southward trend of the tide, which was throwing his vessel and tow broadside to the southward. The fact that he had on several occasions altered the course to the northward by five degrees at a time should have awakened him to the condition existing, hence the court is of opinion that he did not make sufficient allowance for the effect and trend of the ebb tide.

The plea that the ship had not sufficient power or speed to contend against the ebb tide is waived aside by the fact that, on calculation, it was shown that the "Tuscarora" was making 2½ knots over the ground.

If Pouliet was in doubt as to the power or lack of power of the "Tuscarora" he had ample time to suggest anchoring. A safe anchorage could have been easily made to the South of White Island where calm and shoal waters existed, and Brandy Pot Light fully visible.

The point raised with respect to a suggestion made at Father Point to take a pilot or pilots for the tow, but which was not understood by Captain Blake, Jr., is not taken in consideration, as the grounding occurred with the towing ship. The subsequent damage to one of the tugs occurred whilst the three vessels were then under the sole control of the commander of the "Tuscarora," and whilst trying to float her.

Another point which was brought to light is the fact that every light was visible, clearly so, whilst Pilot Pouliot in his report stated that the weather was hazy.

Reports should be in accordance with bare and actual facts, therefore the Court looks with askance and suspicion on any attempt at exaggeration.

In view of the foregoing the court renders the following finding:

Finding

The court having carefully weighed the evidence adduced, and for the reasons given in the report, finds that the pilot, Ernest Pouliot, erred in judgment in not making sufficient allowance for the strong ebb tide which he was encountering, by not steering a more northerly course till well clear of White Island.

Being a young man the court is of opinion that a suspension of his license would, at this stage, be detrimental to the service, and, therefore, in lieu of this the court orders him to pay the costs of this investigation, amounting to one hundred and fifty dollars, which sum shall be forwarded to the chief accountant of the Marine Department, Ottawa, on or before the first of October, 1920.

The court is not conversant with the methods of discipline followed in the United States Navy; but is nevertheless of opinion that the authorities will agree that the bridge should not have been left solely in charge of a warrant officer—the Gunner— who was unacquainted with navigational problems, especially in strange pilotage waters, and who, prior to and at time of grounding, was steering.

Having no jurisdiction in this matter the court submits the above comment and criticisms for the information of the United States Government.

Signed, L. A. Demers, Dominion Wreck Commissioner.

Concurred in by

Signed, Chas. Lapierre,
Signed, J. Couette,
Assessors.

RE STRANDING OF S.S. "J. A. McKEE"

In the matter of a formal investigation in the Wreck Commissioner's Court Room, Montreal, P.Q., on September 13, 1920, before Captain L. A. Demers, F.R.S.A., Dominion Wreck Commissioner, assisted by Captain Charles Lapierre and Captain C. J. Stewart, acting as nautical assessors, into the causes which led to the stranding of the S.S. "J. A. McKee" at 1.30 p.m. on August 26th, 1920, on Lark Reef, in the River St. Lawrence, near the south of the Saguenay River.

Messrs. W. L. Bond, K.C., and L. Beauregard appeared on behalf of the Canadian Government Merchant Marine, Limited, and Master Major Thomas Robb for the shipping interests generally, while Mr. Henri Bernier appeared for the pilot, Edmond Baquet.

Captain James Lintlop, Pilot Edmond Baquet dit Lamontagna, second officer W. H. Betts, and Chief Engineer John Cann, were examined.

Report

The master's evidence amply and fully showed that he had placed entire confidence in the pilot. Though he had several times been up and down the St. Lawrence he thought fit to take a pilot at Father Point, notwithstanding that his vessel was exempt by the Shipping Act and By-laws from payment of pilotage dues.

On this point the court has no criticism to offer. On the contrary the liberty to take a pilot though exempt may enable a master engaged in the coasting trade to obtain, when conditions and weather permit, a well deserved rest.

Nevertheless it is not anticipated, nor permitted and not usual for the master to leave, as in this case, full and entire responsibility to a pilot. Always the master is the sole individual upon whom the responsibility rests.

In this instance the pilot elected to negotiate the northern passage from Red Island, with a view of saving time. The master had never passed between Red Island and the north shore. All went well until Princess Shoal Lightship was made, when an approximate observation of the distance was taken, said to be between 1 and 1½ miles; then a course SW ¾ S magnetic was shaped, which, in ordinary circumstances, would have given sufficient margin. The tide was still flooding, within half an hour of high water; then the fog shut in all objects, and came so dense that objects could have been seen at only a ship's length ahead.

Up to this point the court feels that when the lightship was seen, and before the course was shaped S W ¾ S, it behove the master and the officer, likewise the pilot, to take more accurate bearings, not only of the Princess Lightship, but also of Red Island and White Island Lightship, to ascertain to a certainty if the course would answer the purpose. The fog closed in with the cursory, problematical distance obtained from the lightship and approximate bearing of the fog horn of the said lightship. No advice was sought from the master; the ship was maintained at full speed, 8 knots, with the disastrous result that the vessel was embedded her whole length amongst boulders, and in consequence 70 plates, with frames, etc., have to be renewed.

The court maintains that when the fog shut in the master should have conferred with the pilot about the advisability of maintaining such a speed. Though the master was a stranger in these particular waters, yet he had a chart at hand which plainly showed that strong tide ripples are to be met in that locality, and with ordinary judgment a navigator may expect that on the eve of a change of course tidal conditions influences on a ship's course would alter.

The Rules of the Road are very explicit "in mist, snow, fog, the ship's speed must be moderated." When that rule applies to open waters, in mid-ocean, its observance must be religiously attended to in narrow waters. Had the master consulted the chart and sailing directions and been alive to his responsibilities he would immediately have had his ship's speed moderated and seen that soundings were taken; but whilst these were necessary precautions the court is

justified in stating that the ship should have come to an anchor and waited for a clearance. None of these precautions were taken, nor any consultation had with the pilot. Hence the court cannot arrive at any other conclusion than that the master was remiss in his functions, and forgot his responsibilities.

Pilot Edmond Baquet is a young man, with but three years' experience as a pilot. He avers that by taking the north passage he was attempting to save time. Whilst perhaps there may be a saving in distance, to undertake to steer a ship in such a place, where currents, ripples and eddies are created and exist, caused by the waters tides flowing or ebbing from the Saguenay River commingling with the tides of the River St. Lawrence, requires under ordinary circumstances a perfect realization as to the true position of the ship when shaping courses; but when fog intervenes so dense as to obscure all surrounding objects, then all the necessary precautions that nature and good judgment calls for should have been taken.

In his role as adviser to the master it behove him to at once suggest the necessity of sounding, of moderating speed and then come to anchor.

He stated that such fog with the direction the wind was then blowing is usually of short duration.

His plea that it was dangerous to anchor as the anchors would not hold is not considered by the court as a valid excuse. Vessels plying in the Saguenay have frequently anchored in that vicinity for hours at a time, subject to the full strength of the varying currents.

It was foolhardy on his part to take what he wishes to convey was a short cut, as between Red and Green Island is the proper channel to follow.

He has mentioned the strength of the tide as being 6 to 7 knots. The court admits that such is the strength of the current in spring tides; but on the 26th it was neap tide. Therefore the current is less rapid and the "J. A. McKee" had sufficient speed to contend against the current which was to be met.

On the whole the court cannot see any valid and good excuse for not passing between Red and Green Island, and also fails to accept his plea that he had shaped a right course when he had not taken such observations as would have given him the exact position of the ship. That the statement that some attraction on land may have affected the compass is considered by the court as an attempt to find an excuse.

Summing up the master and pilot should have been united in ordering the speed of the ship to be reduced, soundings taken, and coming to an anchor.

In view of the above the Court renders the following decision:

Finding

The court having carefully weighed the evidence adduced, unanimously agrees that the Master, James Lintlop, failed to exercise that judgment which his responsibilities demanded and in consequence his Certificate No. 3761 is suspended for a period of two months, from September 13th to November 13th, 1920.

With respect to the pilot, Edmond Baquet, the court is reluctant, on principle and on account of his youth, to suspend his license, but owing to the seriousness of the case the court's reluctance is waived aside and it orders his license to be suspended for the remainder of the season of navigation of 1920.

Major Robb, manager and secretary of the Shipping Federation of Canada, brought to the attention of the Court that notwithstanding the fact that coasting vessels were exempt from payment of pilotage dues or taking a pilot, yet agents, owners and masters were prohibited from engaging an individual conversant with the river if they needed one to relieve them momentarily and enable the master to rest, unless the said individual is a licensed pilot.

Major Robb's comments are submitted for the consideration of the officer dealing with pilotage matters.

Read in open court, at Ottawa, this 14th day of September, 1920.

Signed, L. A. Demers, Dominion Wreck Commissioner.

Concurred in

Signed, Charles Lapierre,
Signed, C. J. Stuart,
Assessors.

YARDS HERE TO FINISH THE BOATS

Ottawa Makes That Promise and Winter Work at the Yards Will be Assured

Herbert Wright, business agent of Toronto Local 128, International Brotherhood of Boiler Makers and Iron Shipbuilders, whose members are out of employment through the failure of the Dominion Shipbuilding Company, announced, following his return from Ottawa, that ships which the company was building for the Government would be proceeded with. Osler Wade, assignee of the company, had refused to continue the contracts, since he feared that they would be built at a loss.

"I saw Senator Robertson, Minister of Labor, and he assured me that the Government would proceed with the ships this fall. I don't know exactly when the work will commence, but I believe that it will be when the present vessel is finished," said Mr. Wright. "There was nothing said during the interview regarding labor conditions, which were given as one cause which contributed to the failure of the company. He did not mention it, and I presume the same rate of wages will be paid."

MORE SHIPS TO TOUCH THE ORIENT

Negotiating With an Old Country Firm To Secure Passenger Vessels

Vancouver.—Speaking here at a joint luncheon of the Canadian Club and the Board of Trade, Hon. C. C. Ballantyne, Minister of Marine and Fisheries, referring to transportation and the growth of the Canadian mercantile marine, declared that Canada's ships were built at from $25 to $100 a ton lower than the American, and Canada's ships were much better built ships. Canada has 17 shipyards, he stated, and the Government received the lowest prices of all for shipbuilding from the city of Vancouver.

Sixteen Government ships had been built or were being built here, at an expense of $22,000,000, and all were to be left on the Pacific coast to care for the growing export trade, the Minister stated, and he predicted that in a very short time ships now connected with the Government railways would be plying to the Orient from Vancouver.

"While the Government has not sufficient money to build the passenger ships for this, negotiations are now under way with a large Old Country firm, and when completed the ships should be here not later than in a year's time, and perhaps sooner, the Minister said.

BOOK REVIEW

We have received from the McGraw Hill Book Company, New York, a copy of the "Marine Engineers' Handbook" which is edited by Frank Ward Sterling and contributed to by a staff of specialists. Some well-known names are among the contributors, such as: Rear Admiral Dyson, of the U.S. Navy; Ernest H. Peabody, and A. G. Christie, of Toronto University. The book contains a mass of information of use to the marine engineer. The section devoted to metallurgy is very ocmplete and thoroughly up to modern ideas. Very much attention is paid to oil fuel, internal combustion engines, geared turbines and all the latest developments in marine engineering practice. At the same time the reciprocating engine is not neglected and there is a section devoted to auxiliary machinery. There is an interesting chapter on lubricating and lubricants. The book can be recommended to marine engineers, draughtsmen, etc., as a handy reference volume.

Want Yards Open.—Business Manager Herbert Wright, of the Toronto Union of Shipbuilders, is in Ottawa conferring with the Minister of Marine and Fisheries, urging that they proceed with the construction of the two ships on the ways of the Dominion Shipbuilding Company. These were started before the company was forced into liquidation. The third vessel, that was under way for a New Orleans firm, is being finished by the owners.

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RECOVERING OIL FROM SHALE

By E. R. Hassrick

The next ten years will see a revolution in the use of raw coal, and oil shales will be used extensively in oil recovery, according to a statement by Dr. George H. Ashley, chief of the Topographic and Geological Survey of the Pennsylvania Department of Internal Affairs.

Believing that the increased consumption of oil and gasoline in this country will necessitate the finding of additional sources of supply, he has commenced a study of the possibilities of recovering oil from shales. The use of shale for distillation purposes, according to Dr. Ashley, is an extremely expensive proposition, and he believes that this method of procuring oil for the making of gasoline will hardly be brought into general use until the price of gasoline reaches 50 cents a gallon. At the present time, he says, there has been no decrease in the supply of oil and gasoline in the country, but rather a continuous increase in production. During the last year, however, the demand has exceeded the supply, and the country's reserve stock has been considerably reduced.

In addition, it has been necessary, on account of the exportation of gasoline from this country, to import it from other quarters. He also points out that, although there has been an increase in oil production in this country, the initial production of oil in new wells has been far below the initial production of wells in years gone by. With increasing costs of machinery and operation and a smaller initial flow from new wells, he believes that the present high price of gasoline can, in a measure, be attributed to these items.

In discussing the possibility of securing oil from coal, Dr. Ashley says: "Today, except for metallurgical purposes, we burn coal in a raw state, wasting, when used for power, from 80 to 95 per cent. of the heat and energy in the coal, and all of the oil, gas, tar and other by-products, except as they are burned in the fire. It may be safely predicted that the next ten years will see a revolution in our use of raw coal. Already the by-products coke oven is replacing the old bee-hive oven. The coke is made by the distillation of bituminous coal at a high temperature, around 1,200 degrees F., the by-products being used for heating and illuminating, tar and ammonia. If, however, bituminous coal is distilled at a moderately low temperature, below 750 degrees F., the quantity of gas given off is reduced and coke is replaced by a smokeless fuel, called in one process 'coalite,' having the same heating value as an equal weight of coal, and—oil.

Products Obtained

"A plant operating in England with English coal is reported as obtaining from one ton of coal three gallons of motor spirits suitable for every purpose for which gasoline is used, 16 gallons of oil similar to crude petroleum, which can be used for burning, light, lubricating or for distillation; 7,000 feet of gas, richer in heat and higher in candle-power than ordinary coal gas; 20 pounds of sulphite of ammonia for fertilizing and high explosives, and 1,400 pounds of smokeless fuel.

"Contrasting these figures with those showing the production from by-product coke ovens at high temperature in the Pittsburgh district, it should be noted that these ovens give only 1,100 pounds of coke and no oil, but give 300 pounds of tar and only six and one-half pounds of ammonia sulphite, three gallons of benzol and 7,000 feet of gas."

Pennsylvania is at this time mining about 180 million tons of bituminous coal a year. "If one hundred million tons of that were first passed through such a process as that mentioned," continued Dr. Ashley, "it would increase our oil supply by over one billion gallons, and, remembering that smoke is unburned coal, it may be questioned if the 'coalite' left over and the distilled gas would not supply nearly or quite as much heat as the one hundred million tons of coal."

A Danish company proposes to develop some iron ore deposits in the north-western peninsula of Iceland. These are said to contain from twenty to thirty million tons of ore. The material is a brown oxide containing from 40 to 55 per cent. of Fe, and lies at a height of some 1,000 feet above the base of the basalt rocks.

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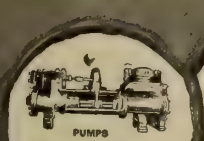

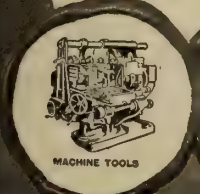

Marine News From Every Source

Sarnia.—Considerable delay is being experienced by the vessels of the Northern Navigation Company owing to labor troubles at Sault Ste. Marie and other lake ports. The "Huronic" on a recent trip was two days late arriving at Sarnia due to this cause.

* * *

Cleveland.— There is still an unfavorable situation in the coal carrying trade, and coal is arriving so slowly that several steamers have had to go up light. Coal shipments for the season to date are 3,000,000 tons behind last season and 6,000,000 behind that of 1918. There is very little chartering being done, and there is a noticeable absence of grain shippers.

* * *

London.—The recent agreement made between the Canadian Government Merchant Marine and the well known firm of Alfred Holt, better known as the Blue Funnel Line, is the subject of much approval in English shipping circles. This arrangement is in addition to that entered into with the British India Co., and will ensure the development of trade all over the Orient from Canadian ports. This is looked on as the best possible answer to the recently passed Jones Bill, which seeks to bolster up U. S. shipping against all comers.

* * *

St. John, N.B.—The figures given out recently by Montreal Harbor authorities show that up to the end of July this year over 27,000,000 bushels of wheat had been handled by two of the commission's elevators, which is double the best previous record. Montreal Harbor has also set up new records in loading and discharging ships, and these results are looked on as being a strong argument in favor of the appointing of a harbor commission for this port. St. John feels that with the proper harbor facilities it could handle more traffic than Montreal.

* * *

Montreal.—An agreement has been made between the Canadian National Railways and the British India Navigation Company, which will provide facilities for the expansion of Canadian business in the Far East. The Canadian Government Merchant Marine and the British India Navigation Co. will, under this arrangement, have an equal number of steamers on the trade between Canadian ports and Java Strait Settlements and Indian ports. The summer port on this side will be Montreal and the winter ports St. John and Halifax.

Toronto.—Mr. F. S. Wood, formerly Agent for the Canadian National Railways at Pittsburgh, is being transferred to Toronto to look after the interests of the Canadian Government Merchant Marine. Mr. Wood has been located at Pittsburgh for the past five years.

* * *

Vancouver.—The Canadian Pacific Railway coast-service will be augmented by a new steamer which will replace the "Princess Sophia" which was lost last year in the Alaskan straits. The contract has been let to the Wallace Shipyards of Vancouver, and the vessel will be 326 feet long with a speed of 17 knots. She will cost about $1,500,000.

* * *

Toronto.—The Canada Steamship Lines will build a new steamer for their Lewiston service, which will be in commission for next season. She will be the largest passenger boat in the fleet, and will be thoroughly modern in every respect. She will be propelled by geared turbines, and will have a speed of about 22 knots. She will have four decks, and a restaurant, dancing floor, moving picture theatre, and a children's playground are spoken of. Pressed steel fittings will be used entirely in the interior, reducing the fire risk to a minimum Passenger accommodation will be provided for 4,000.

* * *

Price of Soft Coal Falls.—Following a complaint made by Admiral Benson, of the United States Shipping Board, that he was compelled to pay $20 per ton for bunker coals, the Department of Justice of the U.S. issued an order to district attorneys to get after profiteers. The department found that coal that was being sold for $20 per ton cost only $5.40 laid down at delivery point. Following this order, the Baltimore market price went down to $8.75 per ton, and even this price was refused by some buyers, who thought a further drop would take place.

* * *

Leave to Take Action Refused.—The Equitable Trust Company, which sought to bring an action against the Dominion Shipbuilding & Repair Co., now in liquidation, was refused permission to do so by Mr. Justice Orde. The Trust Co. claims to be entitled to the unused materials which were secured by the Shipbuilding Company on sums advanced by the Trust Co. through letters of credit. The judge directed that the Trust Company's claim should be preferred in the winding up proceedings instead of an action being taken. The materials will be worked up into the ships in hand.

* * *

Have Contract.—A contract for the mechanical equipment of the Hudson's Bay Company's store at Victoria, B.C., has been awarded to Greene and Lister, plumbing and heating contractors, Winnipeg.

* * *

Material Wanted.—This paper has an inquiry from an American concern asking where the following material may be secured in Canada in less than car lots: Steel channels, angles and plate cut to size, cast iron doors weighing about 1,100 to 1,200 pounds each, steel rods, bolts, nuts, etc., 1-inch diameter steel rods, turn-buckles for 1-inch screws. The address of the firm can be had by addressing the editor of Marine Engineer.

* * *

To Start the Bridge.—Boats have for the past two weeks been making test holes in the rock bed both on the American sides of the Niagara River for the proposed railroad and traffic bridge from Grand Island to the Albert Weaver farm, on the boulevard, a mile north of Black Creek. Mr. Weaver's lease expires January 1, 1921. The railroad will connect Buffalo and Detroit and residents expect a boom in real estate in the county. Real estate men have already secured a number of options at fancy prices. The work will be rushed as soon as the spur to the M. C. Railroad is laid.

* * *

The death occurred at the Moore Convalescent Home in Montreal, of Captain Elisha B. Smith, one of the oldest of the lake sailors. He had a record of service as captain of Lake Ontario, Bay of Quinte and St. Lawrence River steamers extending over a period of 53 years. Captain Smith was 88 years old at the time of his death, which followed three years suffering from acute rheumatism. Captain Smith only had one accident during his long career, and that was when his steamer was sunk in the Cedar Rapids. Happily no lives were lost, although Captain Smith was thrown from the bridge into the river when his vessel struck the rocks. Captain Smith was twice married and is survived by his second wife, whose home is in Toronto. Captain Smith's body was taken to Picton for burial.

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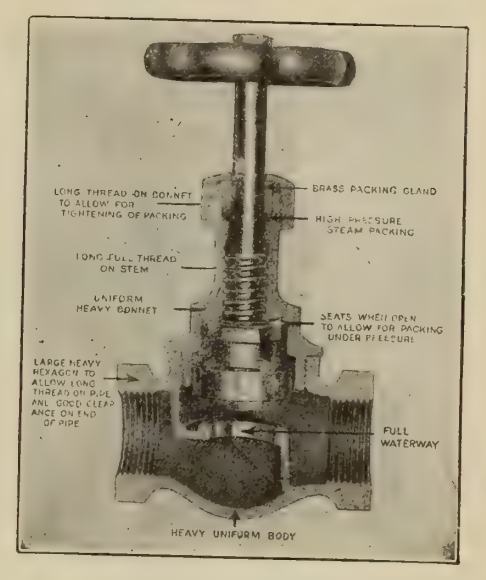
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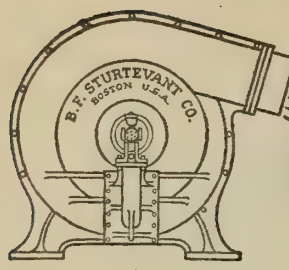

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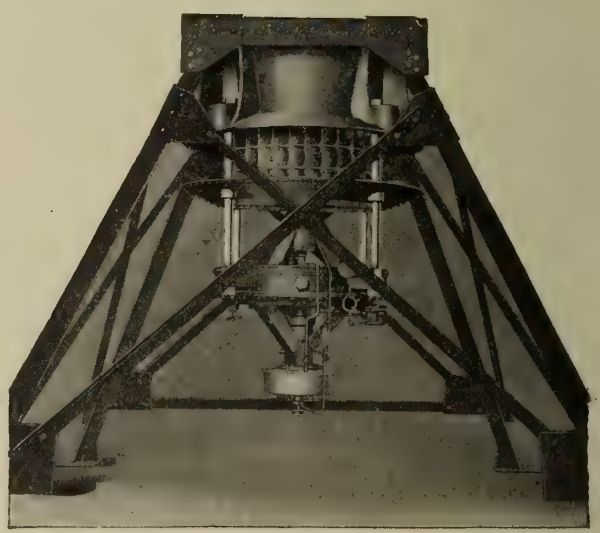

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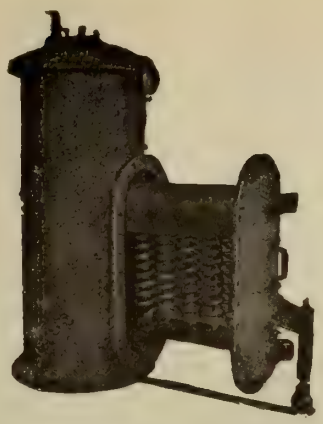
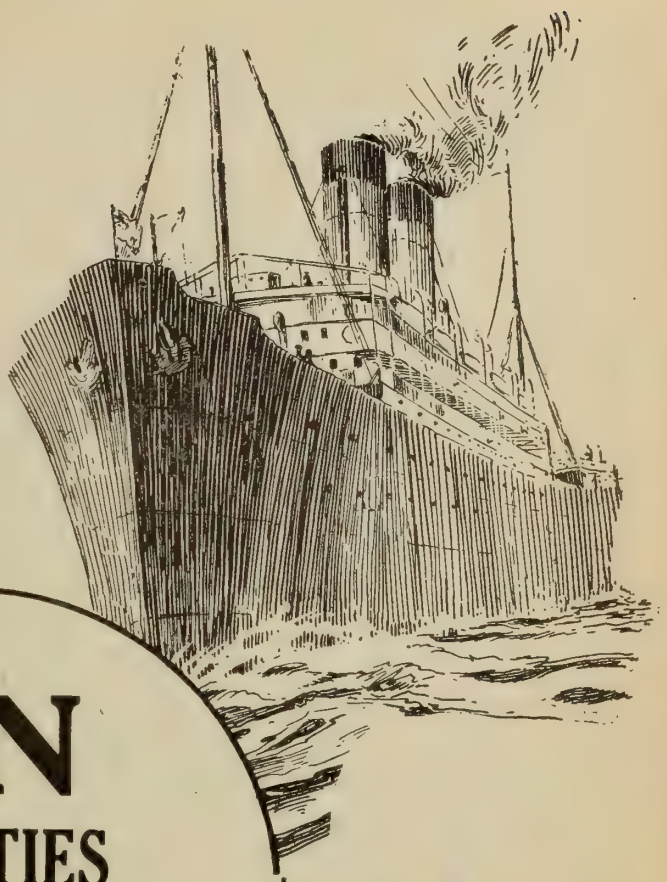


Reilly Marine Evaporator Submerged Type



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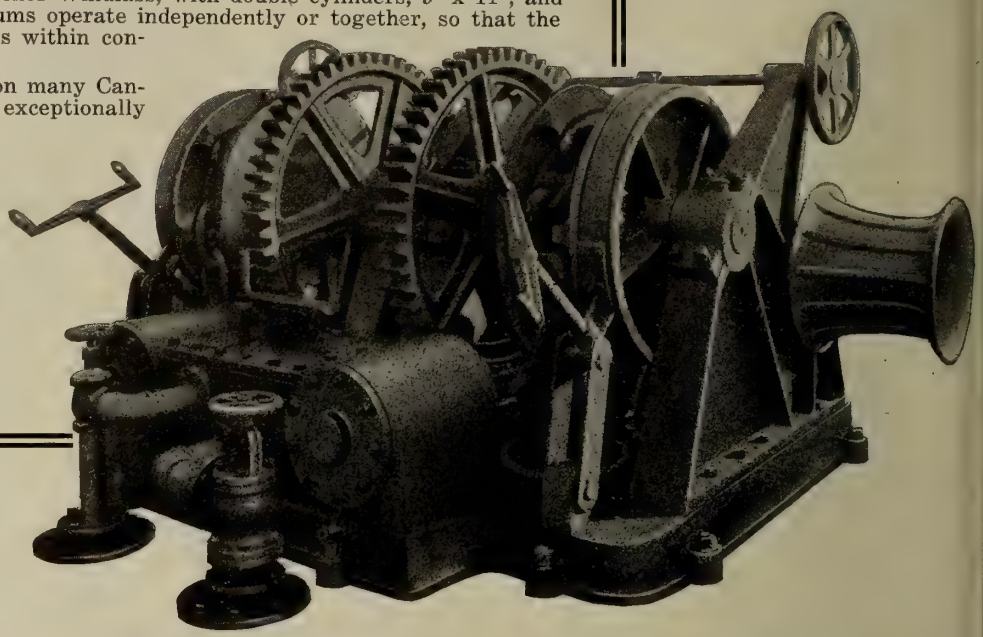

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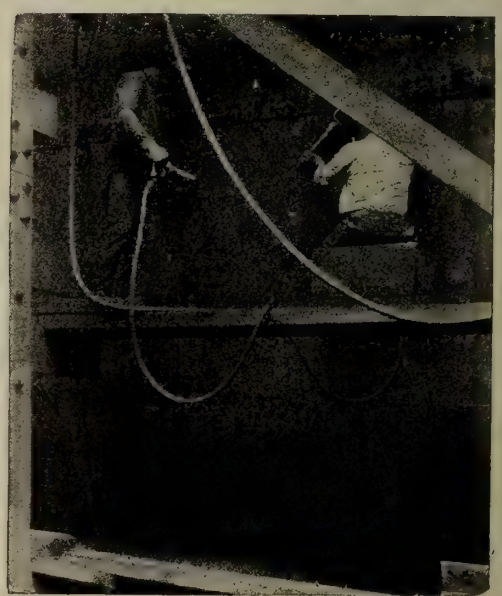

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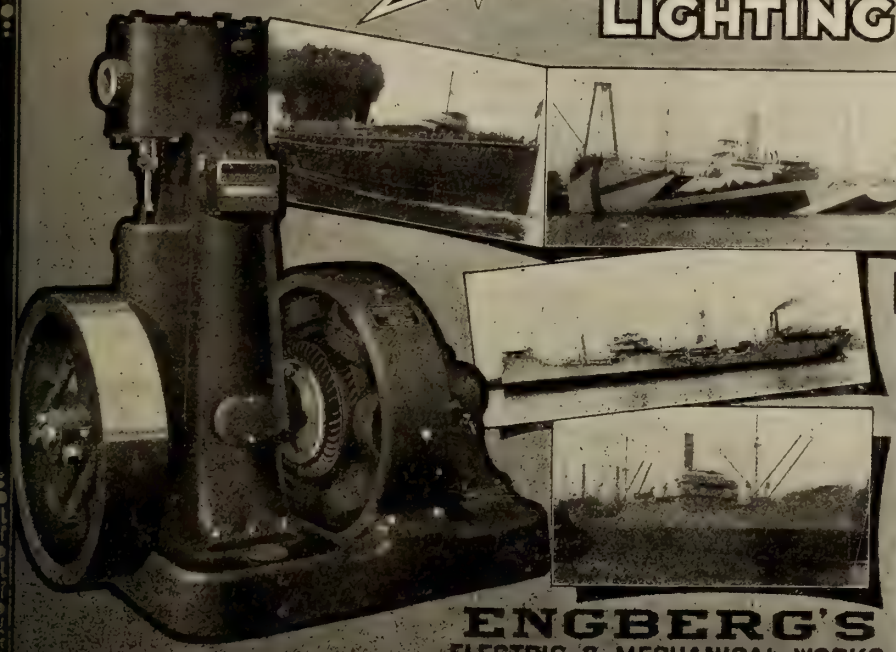

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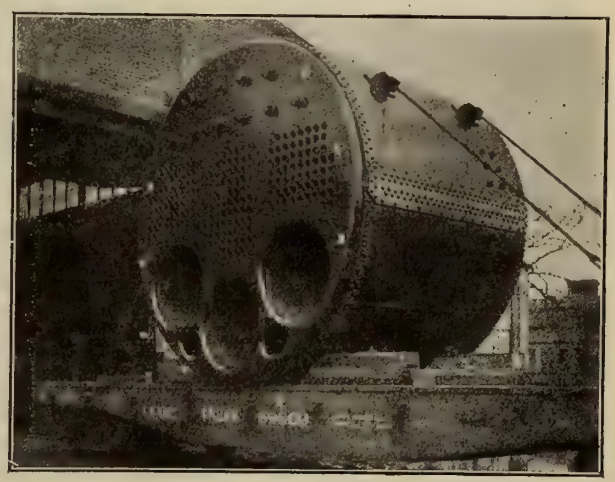

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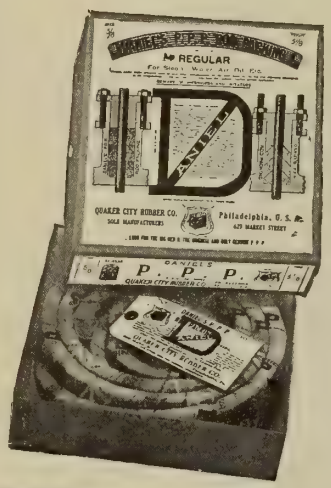

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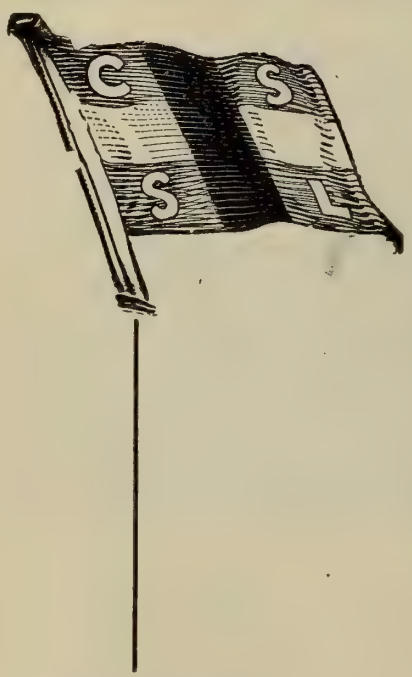

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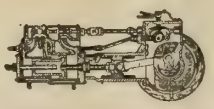

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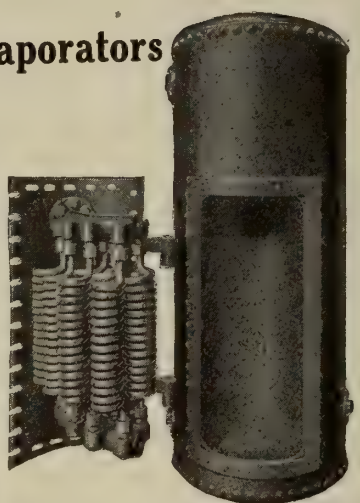

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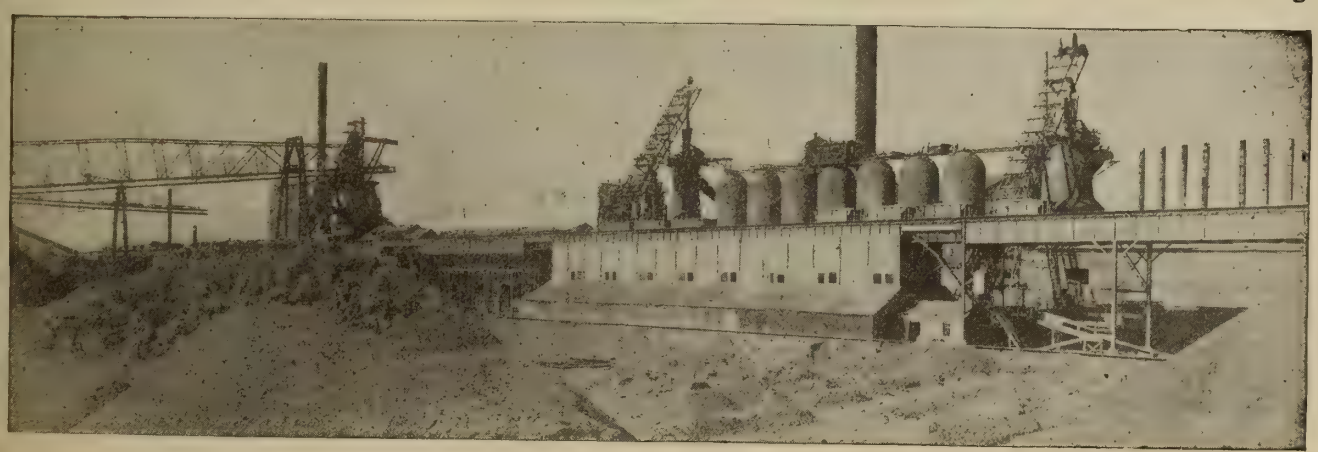

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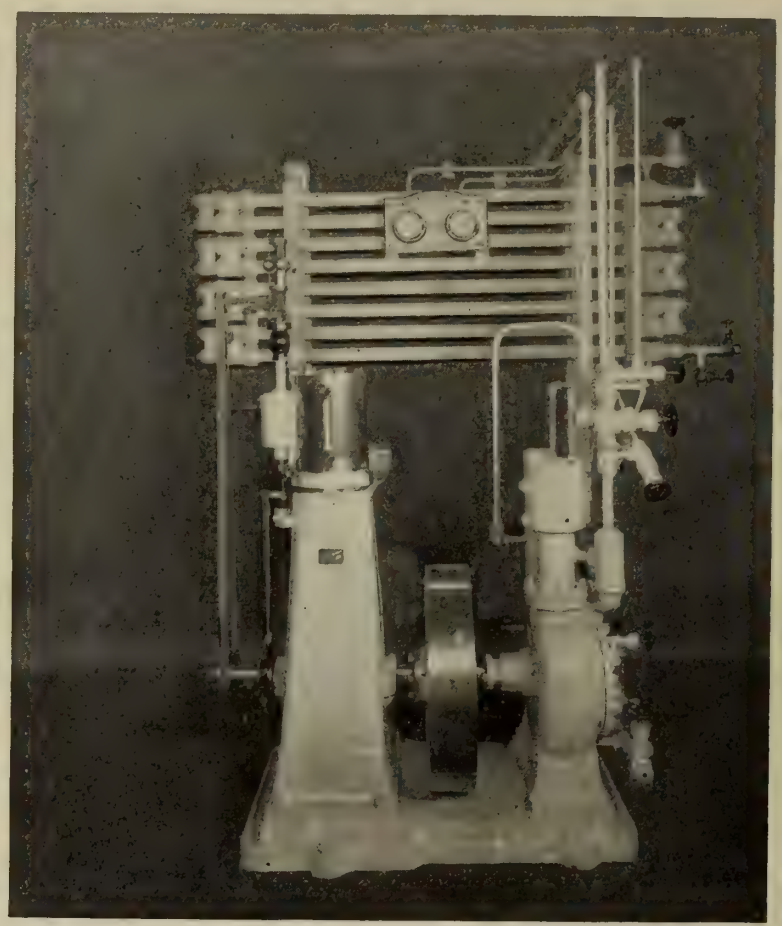

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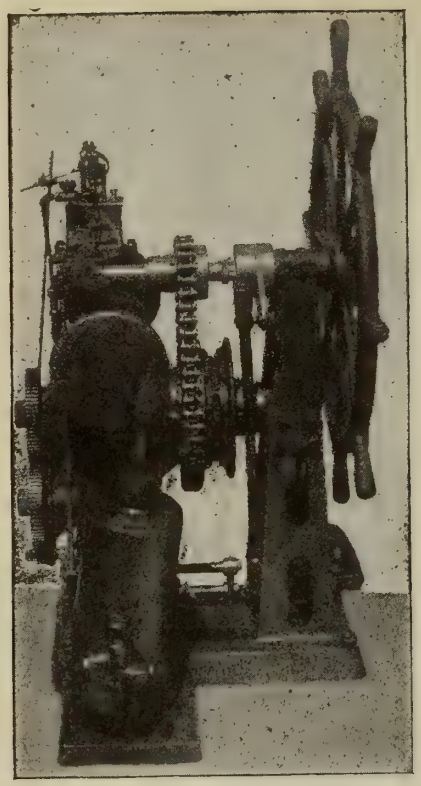

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LINCOLN ARC WELDER

S.S. CHIPPEWA CRACKS CYLINDER

Repaired in 24 Hours

Saved Season's Tie-up by LINCOLN WELDING

THIS news item clipped from a recent issue of a Toronto daily shows exactly what Lincoln welding will accomplish.

Every plant owner and every shipowner should read this article. We will be glad, indeed, if you will communicate with us for further information about Lincoln Electric Welding.

REPAIR WONDERS ARE DONE ON CHIPPEWA

Electric Welding Process Puts Steamer Rapidly Into Commission.

The steamer Chippewa of the Canada Steamship Company's fleet is lying at her dock at the foot of Yonge street to-day undergoing repairs, which are being performed by the same method as was used to get the interned German liners into commission during the war.

It will be recalled that the German crews damaged their ships to prevent them being used by the allies. In most cases cylinders were cracked. The Germans expected that it would take years to get them in commission again, and this view was generally accepted until an engineer, who was consulted, declared that the repairs could be made speedily by the new process of electric welding. As a result the ships were in commission in a few weeks and helped to win the war.

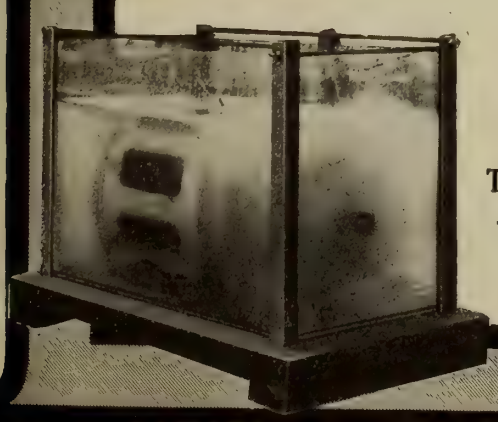
The Chippewa having yesterday developed a small crack in her cylinder an emergency call was sent to the Lincoln Electric Company, 136 John street, who are experts in electric welding. The work of repair began at six o'clock last night, continued all night, and will if is expected be completed some time to-day when the Chippewa will be ready to go back on her regular run. It is said that by previously known processes the repairs would have probably involved putting the boat into drydock and going out of commission for the rest of the season.

A truck carrying the power engine operating on the dock beside the Chippewa attracted the attention of all lake-front visitors to-day. From this truck wires led the current to the scene of operations, in the interior of the boat.

Electric welding is one of the most interesting of the new industrial processes. It has come into use in Toronto only within the last year or two, but already a large number of important firms have installed electric welding equipment and staff.

Toronto to Ottawa

Toronto Star Aug. 7, 1920



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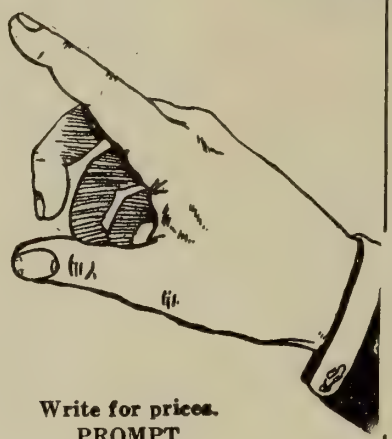

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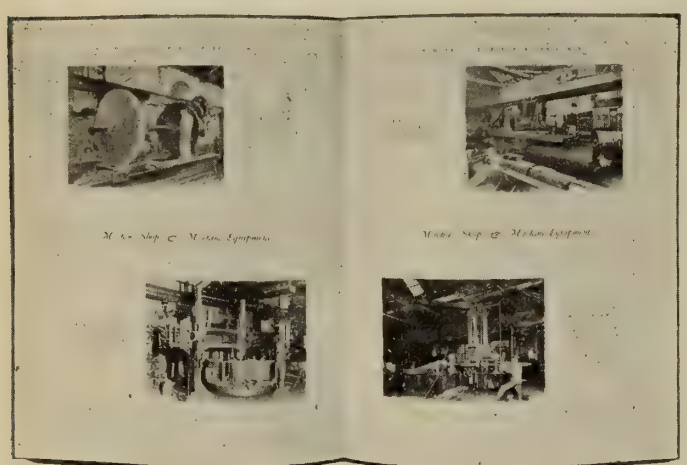

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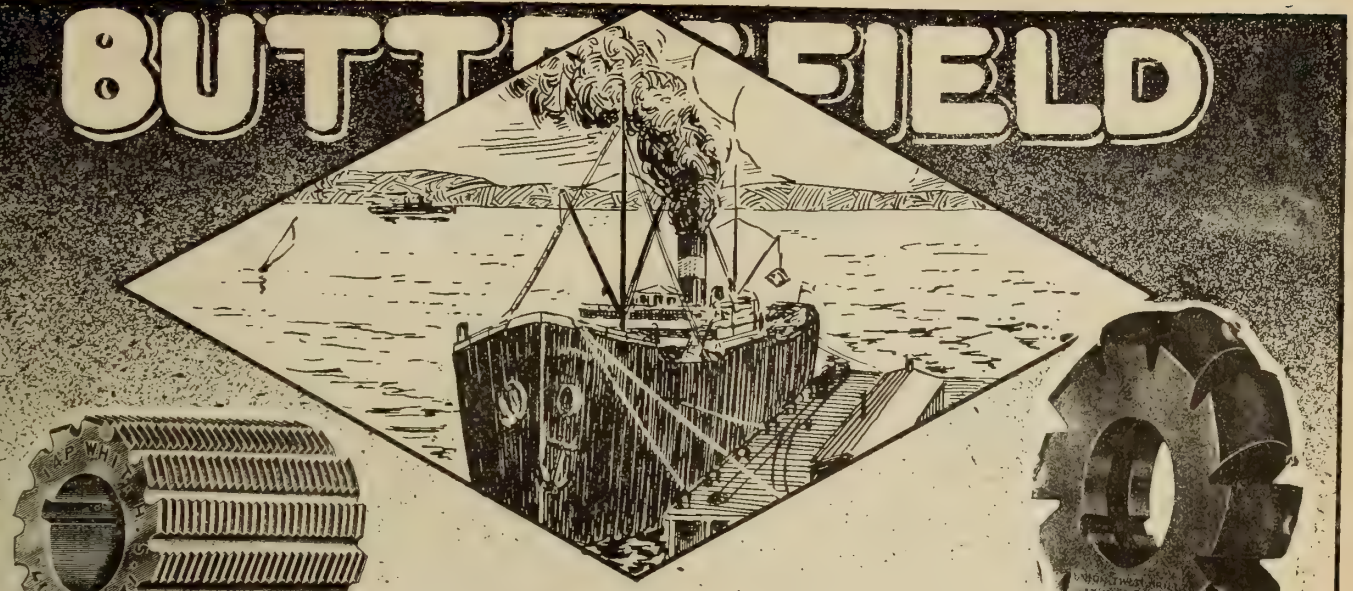

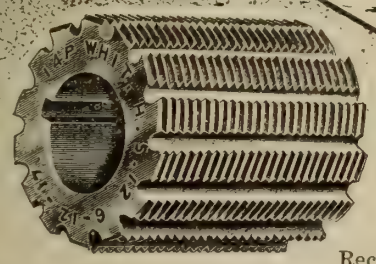

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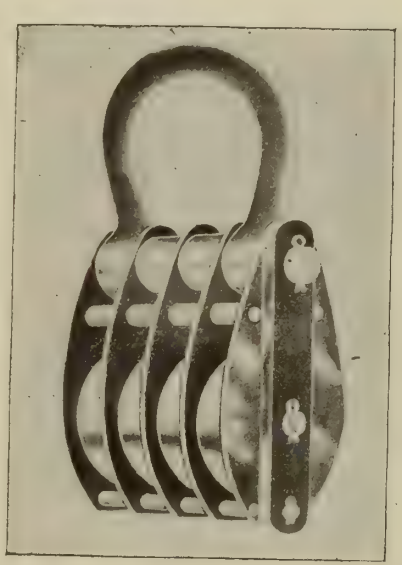

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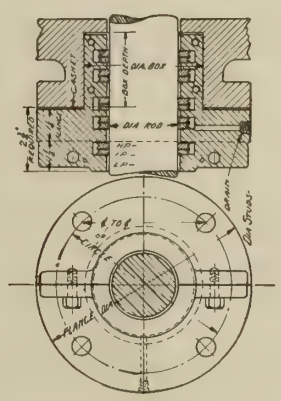

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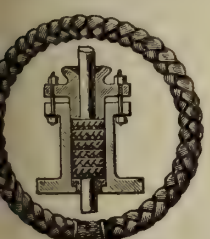

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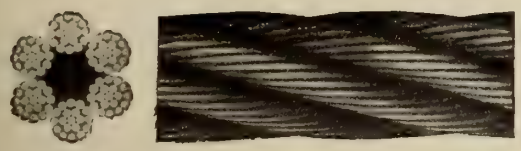

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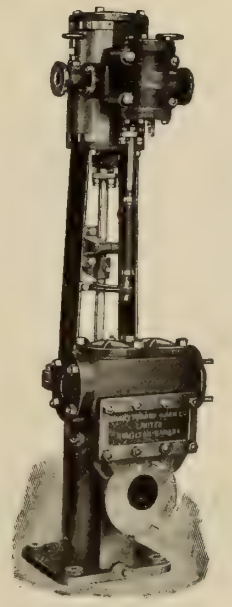

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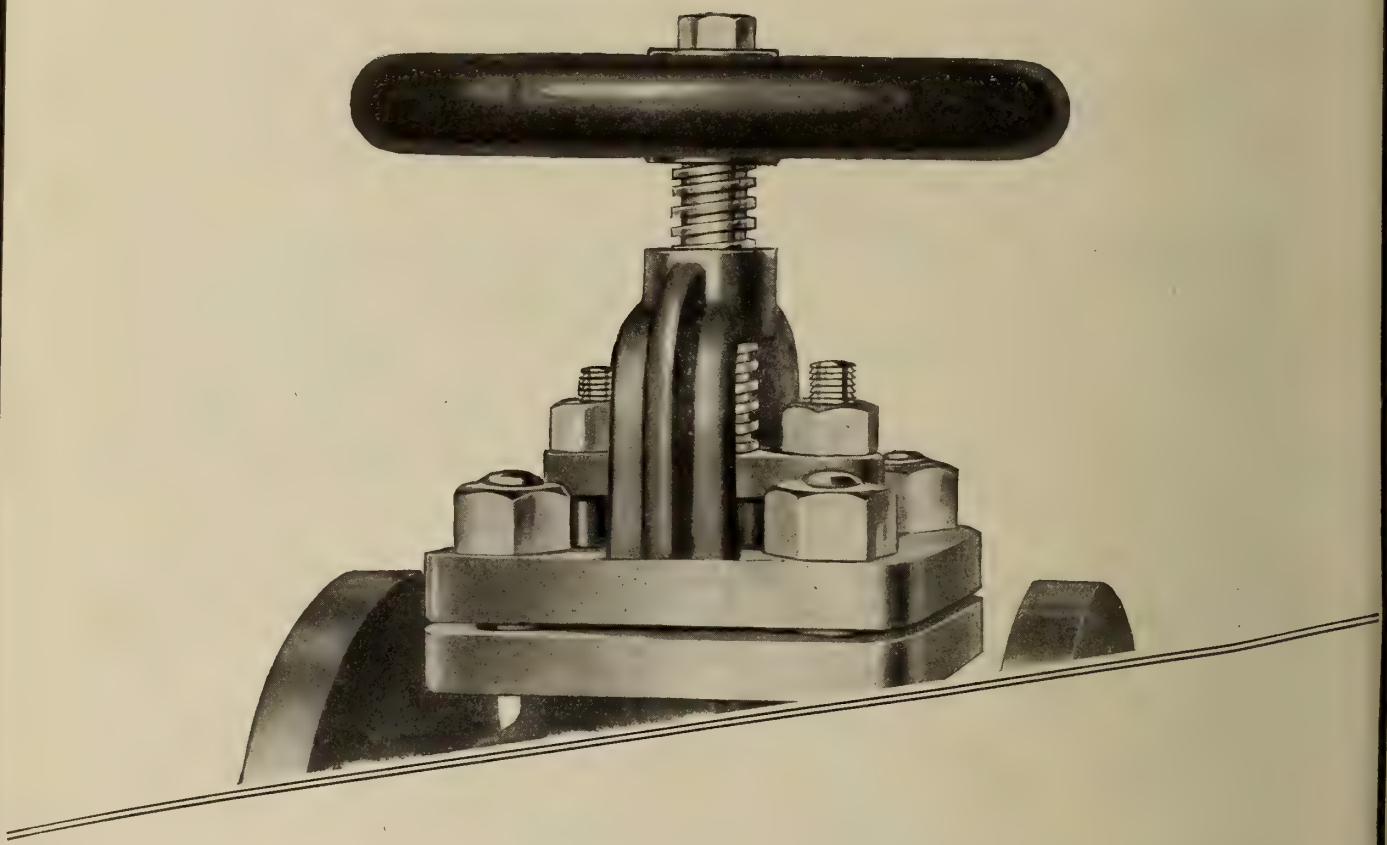

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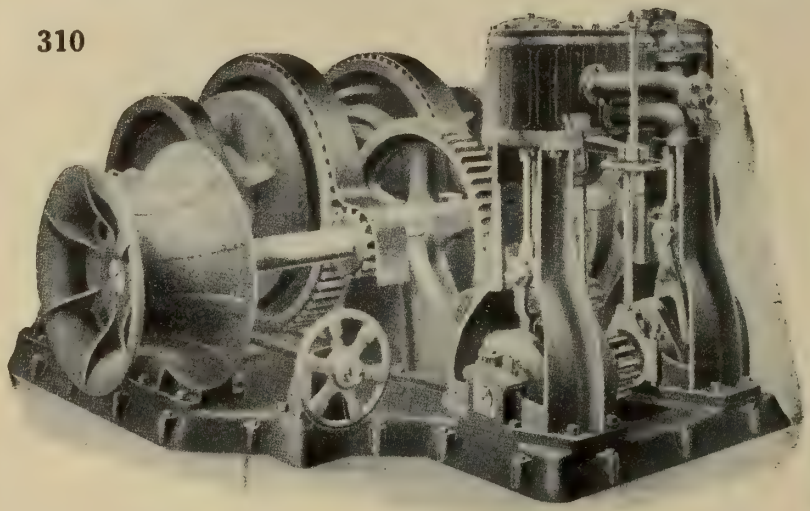

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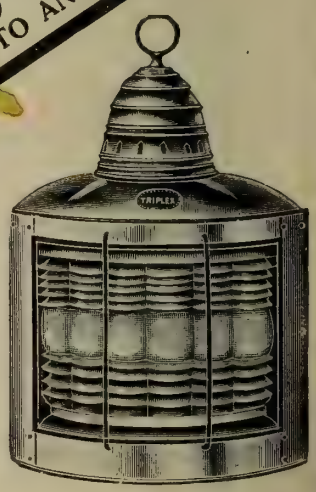

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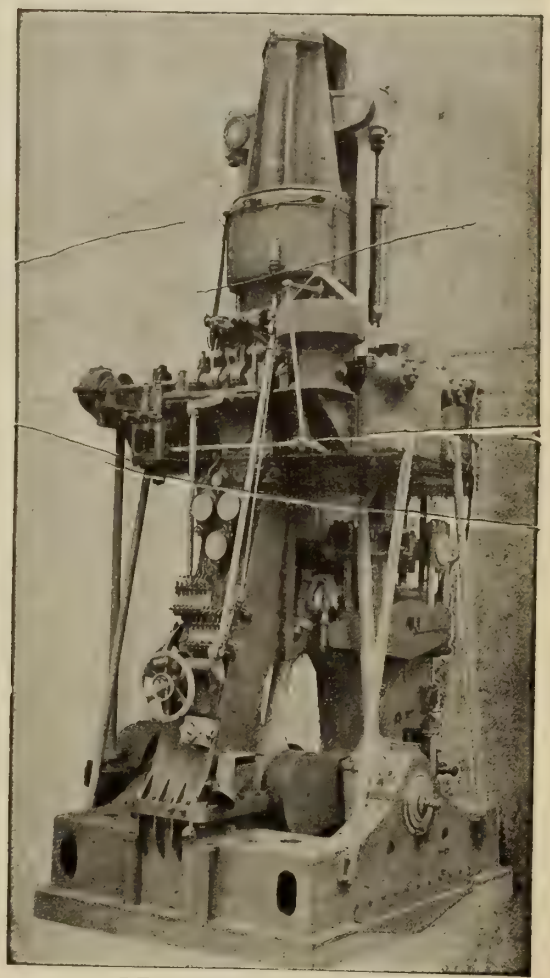

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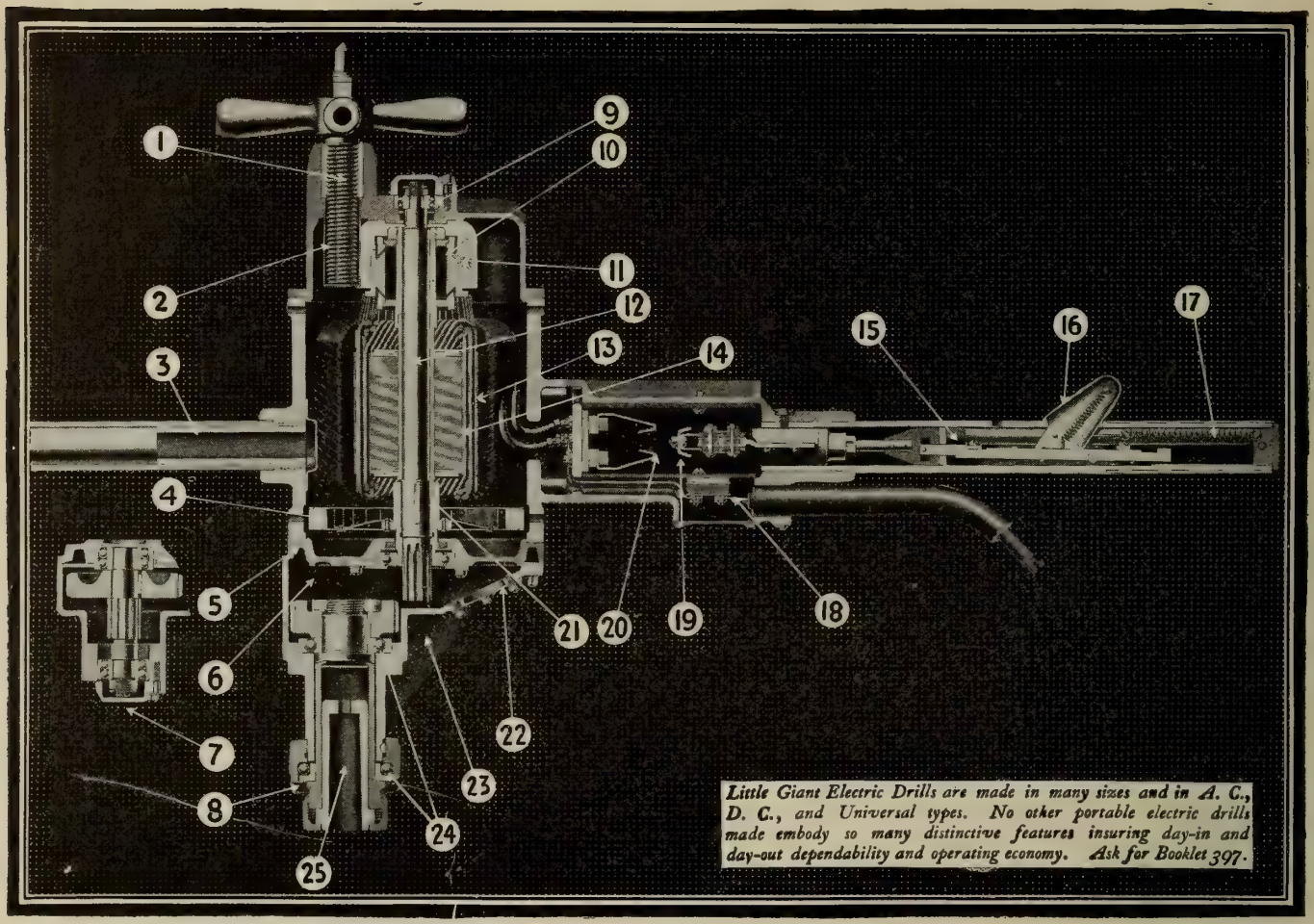

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6 Liberal grease compartment for providing reliable lubrication of gears and ball bearings.
7 Section thru intermediate gears. Note wide *double* row of ball bearings at each end of gear shaft (used on large drills). Pinion and gears made of special alloy steel carefully heat treated.
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19 Cover plates on each side of switch, providing easy access to switch contacts.
20 Double pole, double break switch. Rugged contacts are readily removable.
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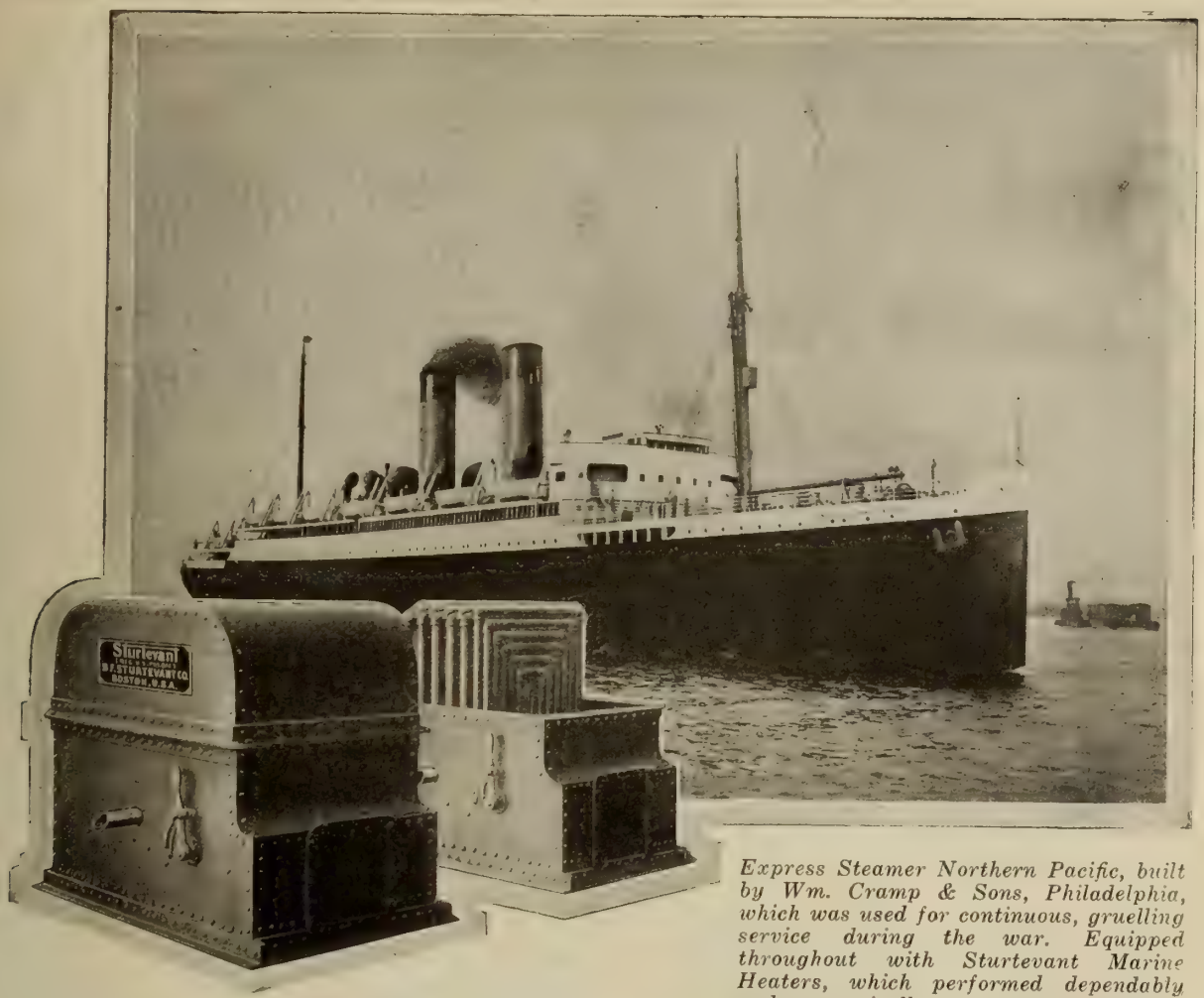

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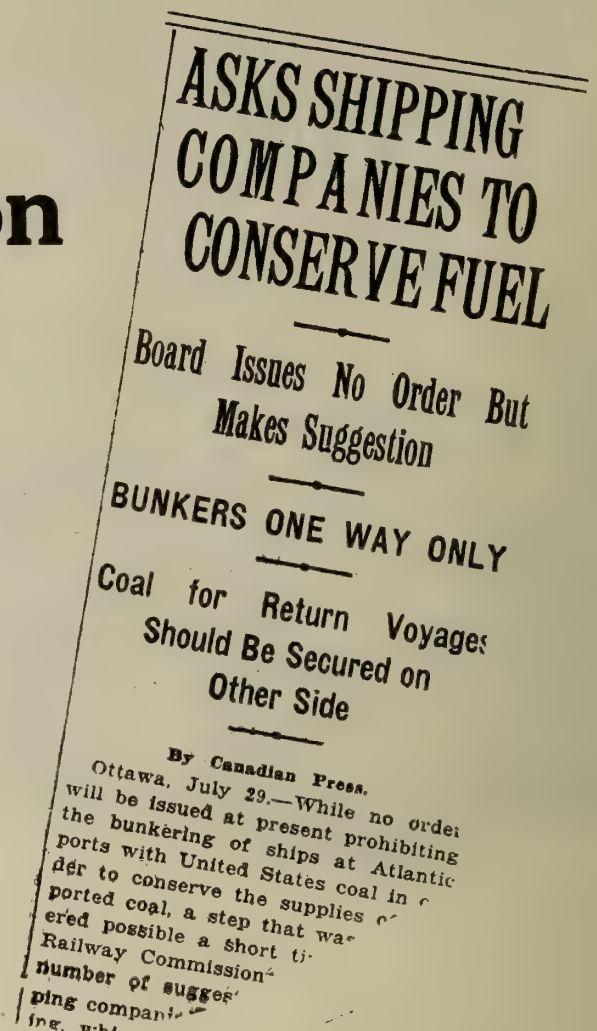

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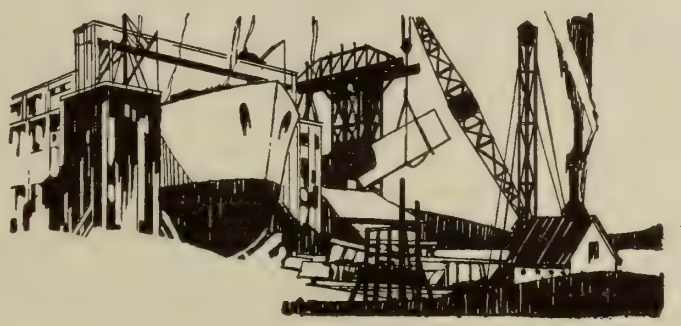

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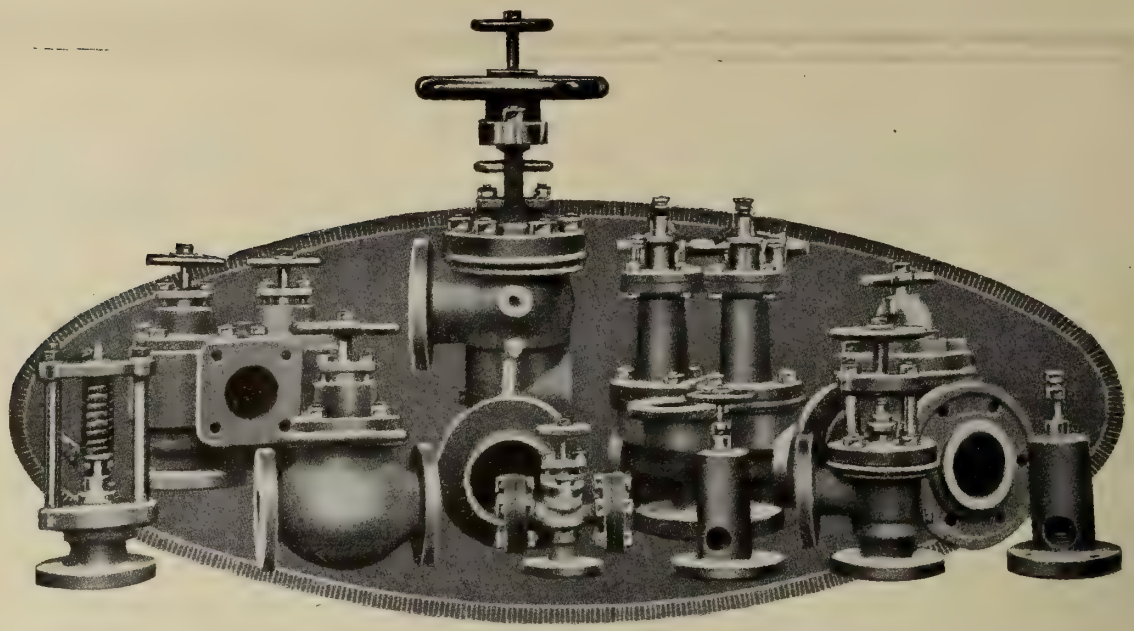

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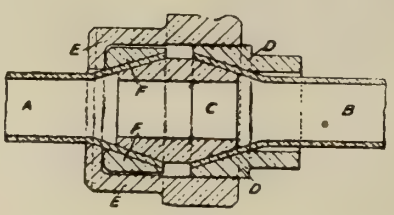

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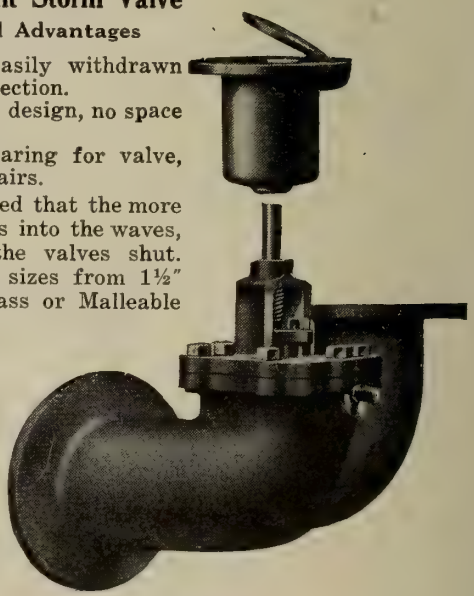

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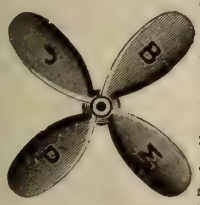

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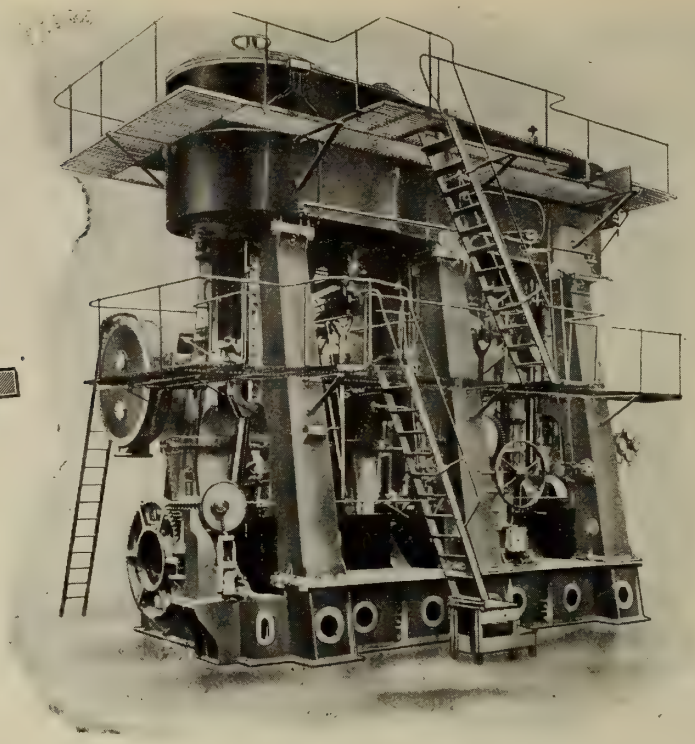

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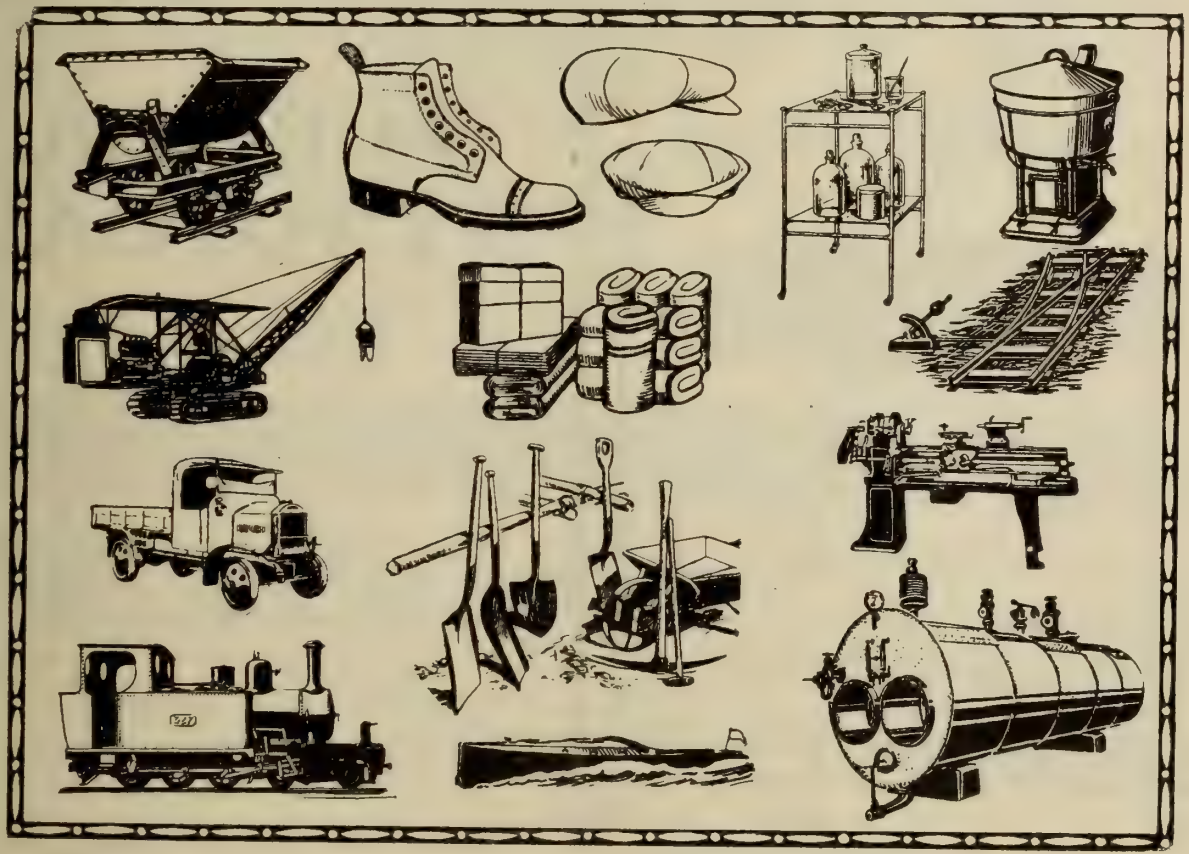

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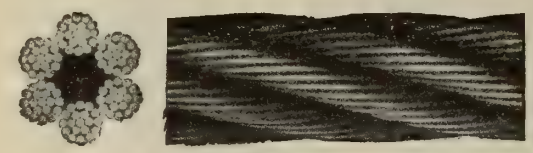

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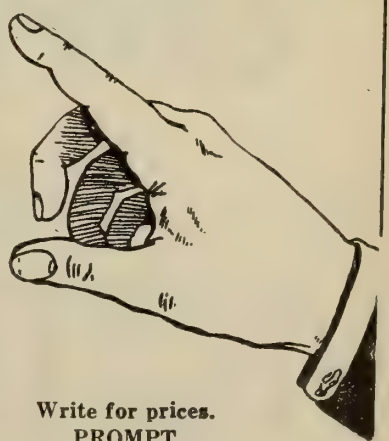

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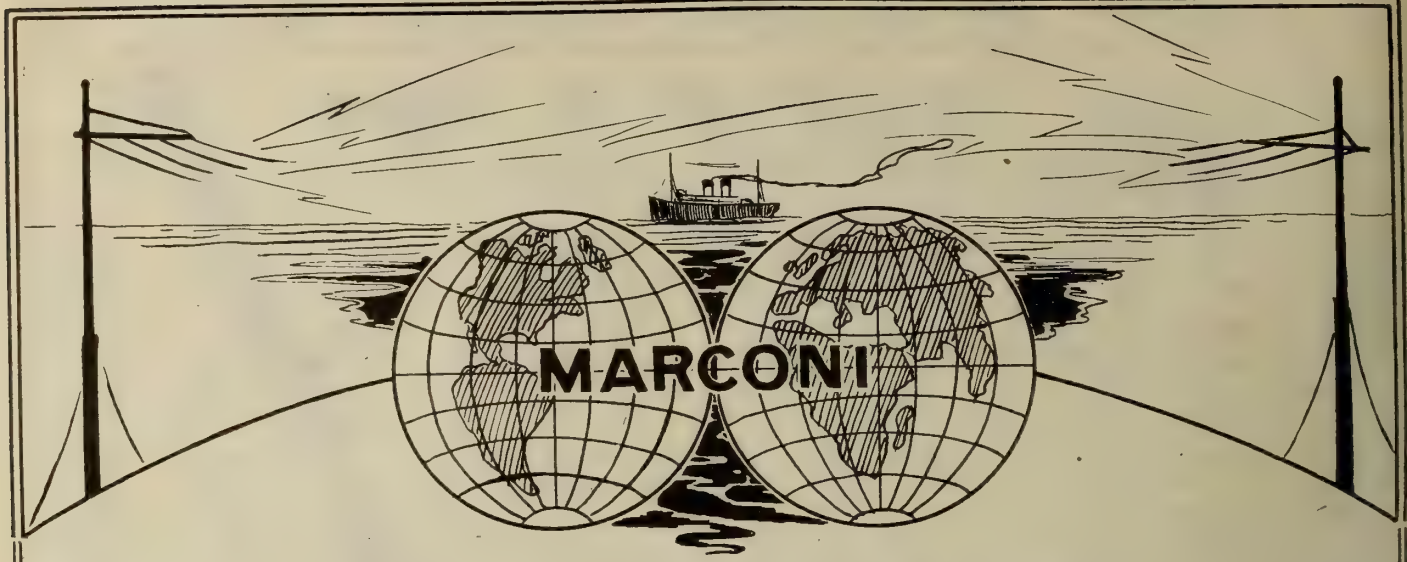

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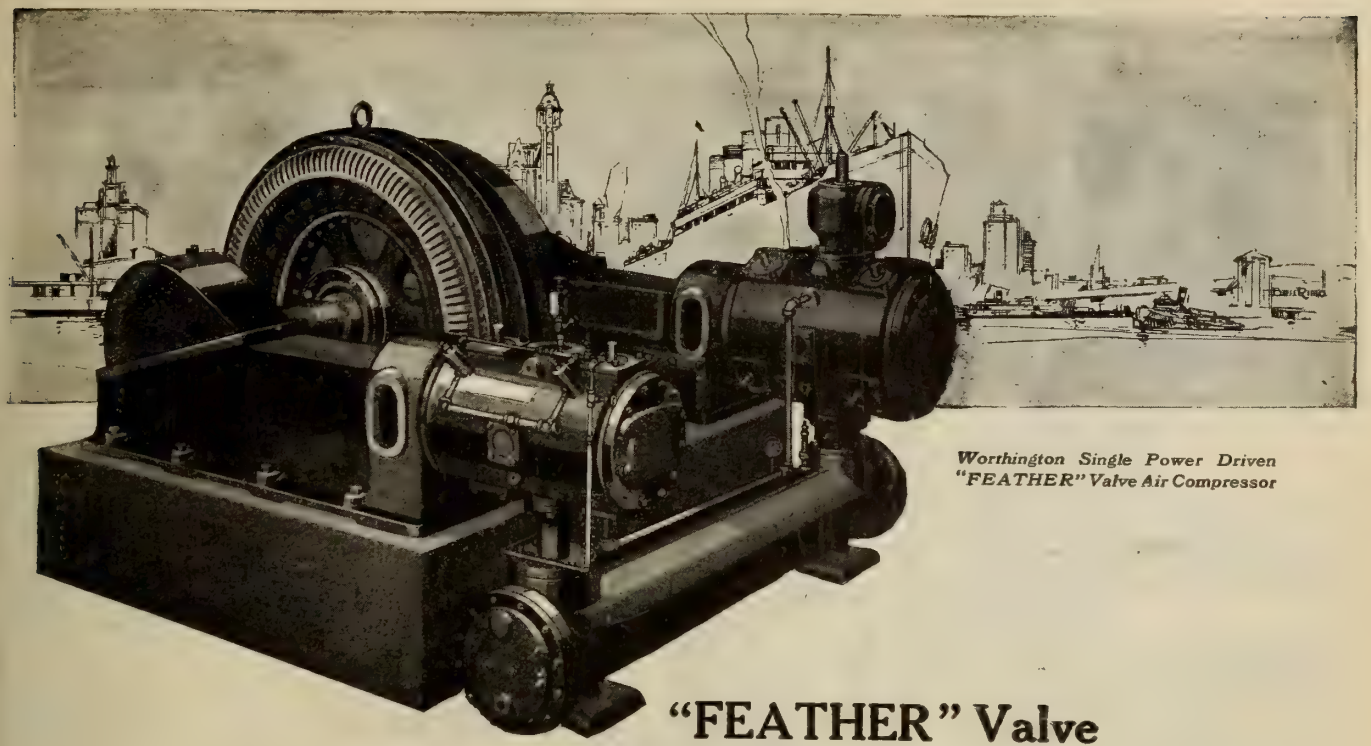

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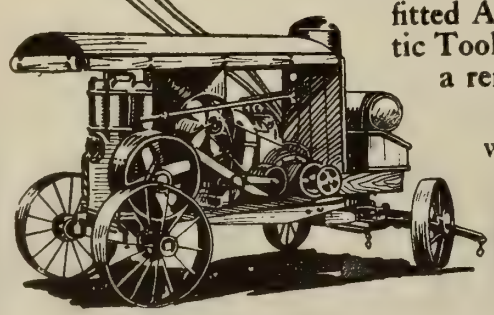

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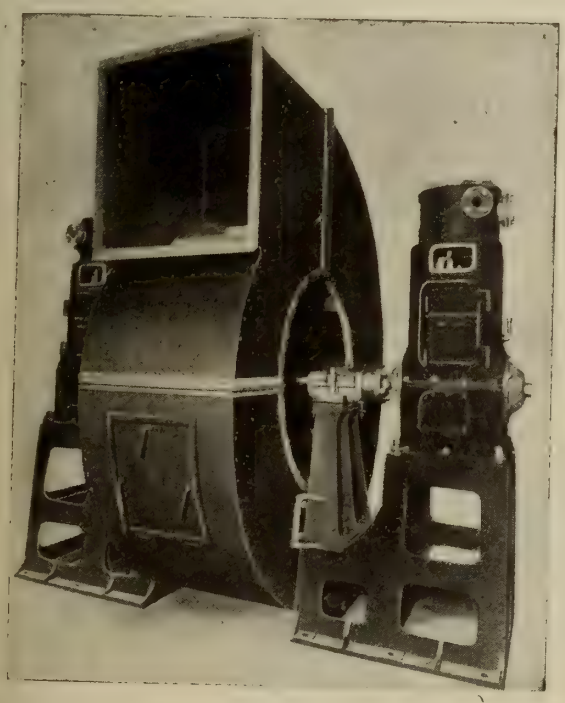

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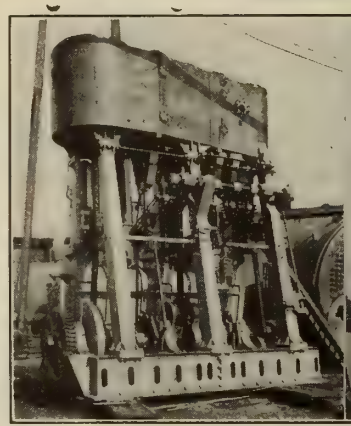

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MARINE ENGINEERING
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Canadian Merchant Service Guild Review

Vol. X. OCTOBER, 1920 No. 10

A High Compression Marine Oil Engine

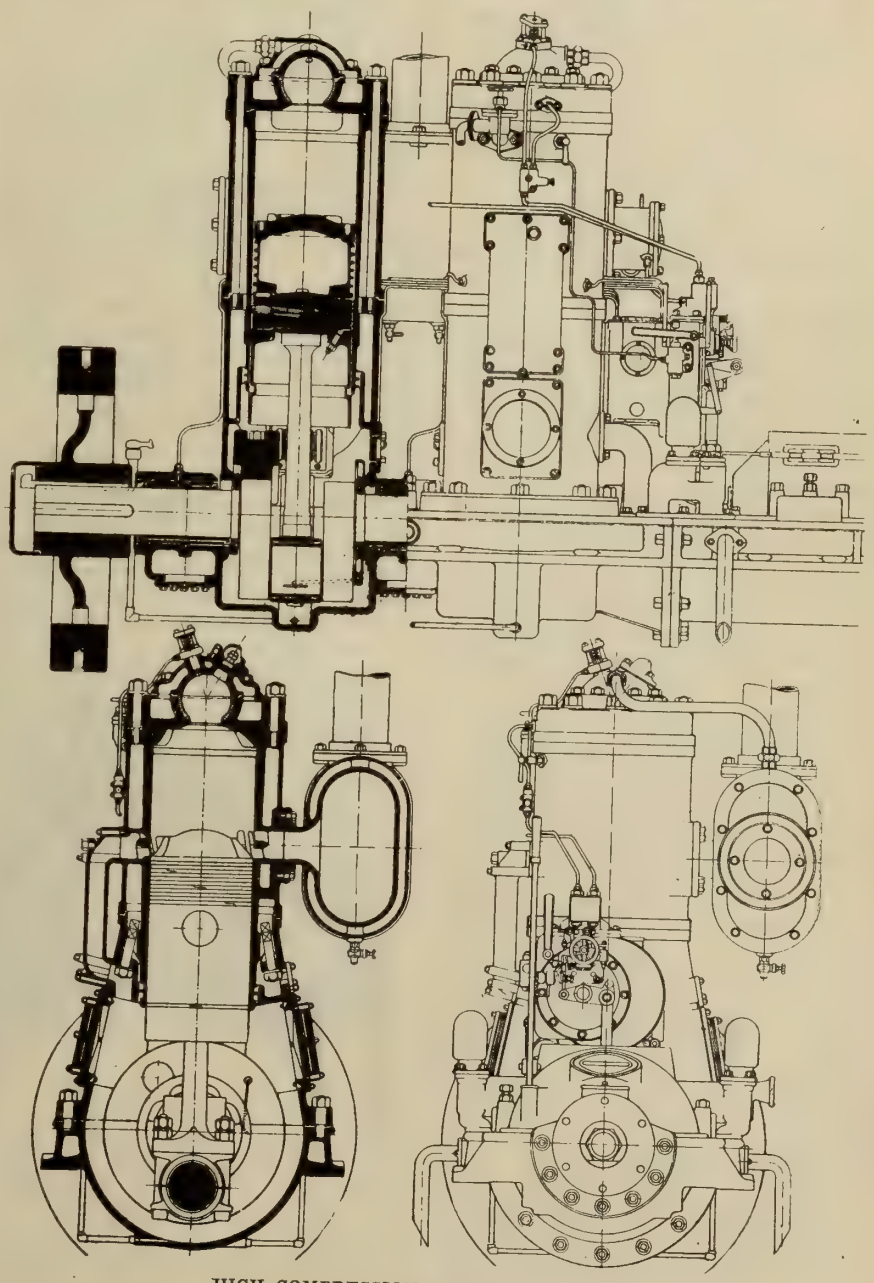
A Detailed Description of the Marine Oil Engine Built by Plenty and Son, Limited of Newbury, England—This Article is Reprinted by Courtesy of "The Engineer."

WE RECENTLY had an opportunity of inspecting at work a new type of two-stroke marine oil engine, which has been brought out by Plenty and Son, Limited, of Newbury, and embodies several rather novel features in its design.

This engine, which is illustrated by drawings and half-tones engravings, has been designed primarily for marine work, but it is, of course, equally suitable for any other class of service where continuous running at full load is the normal condition. For this reason the machine is very substantially built, and will pass Lloyd's survey, while the attention it requires when running is reduced to a minimum.

On reference to the line drawings it will be noticed that the arrangement of the cylinder and crank case is distinctive. The cylinder proper and its water jacket are formed as a simple casting in which the two parts are only connected together at the top end, except where the inlet and outlet ports pass through, and these made as flexible as possible. The joint between the bottom of the cylinder and the water jacket is a sliding fit, and is kept tight by means of a couple of rubber rings. The result of this arrangement is that the cylinder is more or less free to expand downwards as it warms up in working. The crank case, it will be seen, is carried up to a good height and long through-bolts are used to clamp together the cylinder cover, cylinder and crank case, and to take the force of the explosions without putting the cylinder casting in tension. A couple of T-headed bolts, shown in the cross section, are used to hold down the cylinder and prevent it coming up with the cylinder head when the latter is lifted off for inspection purposes. The water jacket is continued right down to the bottom of the cylinder, and spreads, in a saddle-like shape, down the sides of the crank case. Water passages are also formed under each of the main bearings and down the sides of the bed-plate. The cooling water first circulates through these passages and then rises, by way of the cast iron pipes, which can be seen in the engraving of the two-cylinder engine, into the bottom of the main water jackets. Water jackets are also arranged right round the combustion chambers and the silencers. The general scheme for cooling the engine is, in fact, very effective, and we found that even after it had been running some time, the interior of the crank case was quite cool, which, of course, is a specially good feature in an engine using crank case compression.

It will be noticed that the illustrations show a separate trunk for conducting the compressed air from the crank chamber to the cylinder, but the makers inform us that it is their intention, in future, to core this passage out of the main casting. The air



HIGH COMPRESSION MARINE OIL ENGINE.

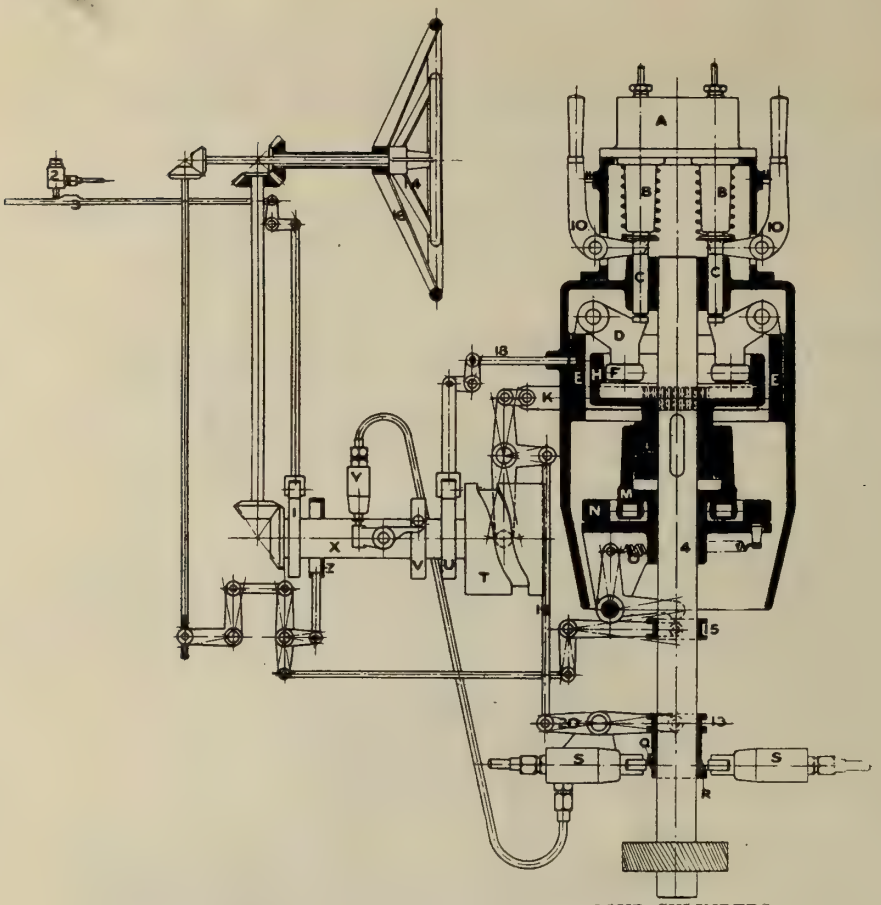


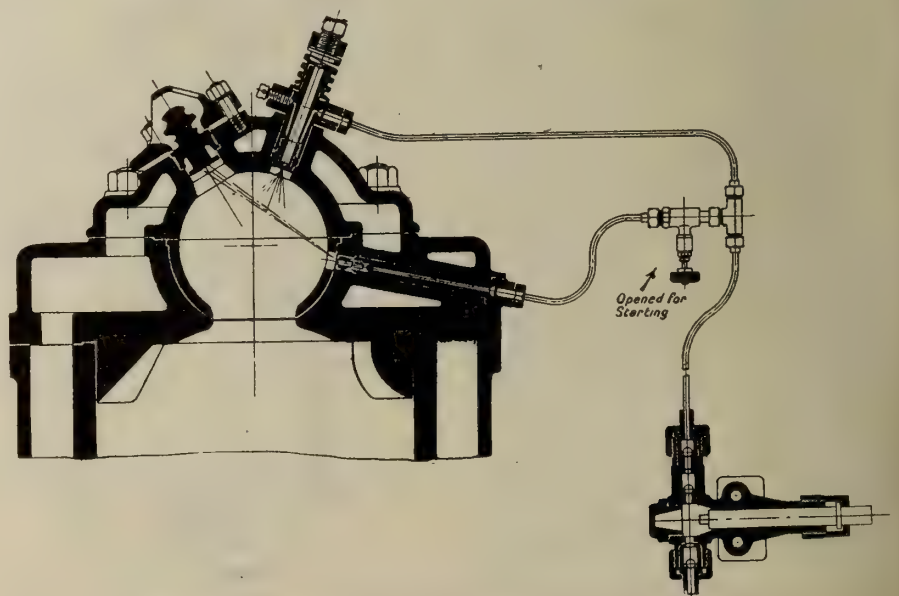
FIG. 5—MANOEUVRING GEAR FOR THREE OR FOUR CYLINDERS.

inlet valves are made of narrow strips of spring steel, and are arranged in the crank case doors. These doors are of such a size that the big end of the connecting-rod can easily be attended to if necessary. Other handholes are provided in the sides of the case to give access to the banjo used to lubricate the crank pin.

The combustion chamber, it will be noticed is of spherical form, and is fitted with a cast iron liner which can easily be renewed when it becomes oxidised. There are two injection valves and an ignition plug, all of which are plainly shown in the detail drawing Fig. 2. The ignition plug is merely a mushroom-shaped piece of nickel, which can be heated, when the engine is to be started, by playing the flame of a blow lamp on the protruding extension. One of the injection valves is so placed that its jet is directed on to the ignition plug. This jet is only use for starting up, and it is so proportioned that it will produce a spray with an oil pressure which is insufficient to lift the spring-loaded valve of the main jet. It is thus only necessary to open the small oil valve shown and to heat up the ignition plug to get the engine ready to start. As soon as the engine is under way the oil valve is shut and the main jet takes up the work. The auxiliary jet, as will be seen, is well protected from the effects of combustion during normal running by the cast iron liner and the makers tell us that it will work quite satisfactorily even after it has been out of service for some considerable time.

Two distinct systems of governing are adopted, according to the number of cylinders in the engine. Those of one and two cylinders are fitted with a governor of the hit-and-miss type, which by-passes the fuel oil pump; while the larger engines are controlled by varying the stroke of the pumps. The first mentioned type of governor is shown in Fig. 4 as arranged for a two-cylinder engine. At the top of the drawing there are shown the spindles of the two by-pass valves, which are opened when the cams are rotated. On the right there is an ordinary hit-and-miss trigger, which, in the event of the speed becoming excessive, will strike the bell crank and rotate the first by-pass cam. A short horizontal plunger transmits the movements to the other cam. After rotation the cams are held by detents and the fuel is by-passed. On the next stroke the trigger strikes a pad at the end of the detent, that is to say, of course, if the speed has fallen sufficiently for it to escape the bell crank, and the cam, being released, is returned by a coiled spring. Even then, however, the by-pass is not entirely closed, as there are two steps for the detent to catch, and a second stroke must be made before a full charge is injected into the cylinder. The engine is thus relieved from the violent thumping experienced when a full charge is injected into a cylinder which has been thoroughly scavenged by running light for several strokes. The tripping of the detent for the left-hand cam is effected by a small roller, shown on that end of the rocking lever, striking a tappet rod. The fuel pumps are driven by another rocking lever, on the same spindle as the governor rocker, and are totally enclosed in a circular casing on the end of the engine—see Fig. 1. The eccentric which is used to drive the rocking lever also operates the circulating pump and a bilge pump.

A diagram of the system of governing used on the three and four-cylinder engines is given in Fig 5. In these cases, as already mentioned, speed is controlled by varying the stroke of the fuel pumps. The pumps B, B are grouped, according to the number of cylinders, round a block A. The suction strokes are accomplished by means of the springs shown, and the delivery stroke by means of the tappets C. H is a cam having the track formed on the internal surface in contact with the roller F. The cam face is made of such a form as to give the required timing to the injection, and is also made so that its surface is inclined to the axis of revolution. The cam transmits motion to the tappets C by means of the rollers F and levers D. It will be noticed that the maximum stroke of the pump is governed by the position of the levers 10, which can be adjusted by means of the stops 11. The cam H is carried on a sleeve, which is free to slide vertically but is driven by a feather on the shaft. As the cam surface is at an angle to the centre line the movement of the cam in a vertical direction will vary the stroke of the fuel pumps. The levers D are carried on a cylindrical member E, which may be rotated by the rack K, and the timing of the injection thus altered



COMBUSTION CHAMBER AND WORKING AND STARTING SPRAYS.

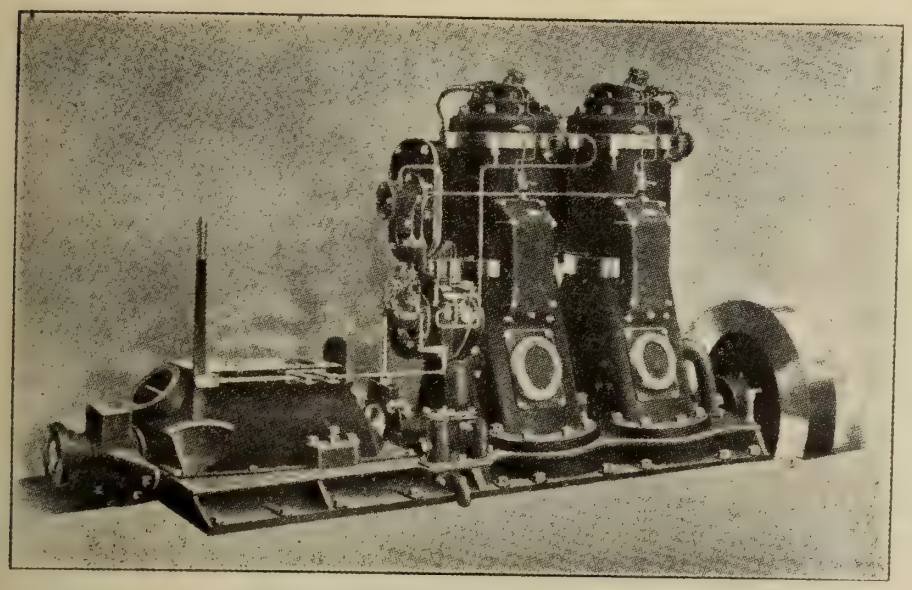


FIG. 1—TWO-CYLINDER 50 H.P. PLENTY ENGINE.

at will. The governor is of the horizontal type mounted on the vertical shaft 4, which also carries the cam mechiansm, and is so arranged that on the weights N moving out they will cause the rotation of the nut M. This nut works on a thread cut upon the cam-carrying sleeve L, and hence its rotation will move the cam H in a vertical direction and thereby alter the fuel pump stroke. Upon the same vertical shaft a cam 13 is carried for operating the air-startir g mechanism of the engine. This cam has two cam surfaces Q and R, one for ahead and one for astern, which will operate the air valves S.

The speed of the engine is controlled by means of the hand wheel 14, which connects with the levers coupled up to the sleeve 15, and thereby alters the tension of the governor springs O. These levers are interlocked with the manoeuvring gear by the bolt and cam Z, in such a manner as to prevent the engine being started or manoeuvred except when the speed control is set for slow. Manoeuvring is accomplished by means of the large hand wheel 16, which is geared to the shaft X, carrying the various cams necessary. The cams are firstly a scroll and their levers are so arranged that they will only be operated when the shaft X is rotated in one direction. The cam 1 is a relief operating gear which by-passes all the fuel from pumps, and hence stops the engine by means of the valve 2 and lifter 3.

The method of operating the gear is as follows:—The diagram shows the gear with the engine stationary. The first movement of hand wheel 16, by rotating the shaft X, moves rack K through the levers and cam T, so as to retard the time of injection. At this time the cam U is in operation, holding the locking gear 18 out of gear, as also is the cam 1, which is by-passing the fuel. The cam T also moves the sleeve 13 by means of the levers19 and 20, so as to bring the correct air-starting cam into operation. The next movement of 16 brings the cam V into work, operating the main air valve Y and allowing air to enter the starting system, and the engine commences to rotate. During this period of movement the cam 1 will come out of operation, allowing fuel to enter the cylinders, and the engine will commence to fire. Further rotation of the hand wheel will put the cam V out of operation, and will advance the injection by means of the cam T. Finally, the projection on U will lock F in the working position. The gear is now in a position to allow the speeding up to be carried out, as the interlocking bolt will be opposite a hole in Z. To stop the engine the hand wheel is turned back in the opposite direction, the various cams going through their phases of operation, with the exception of the air cam V, which will not operate on the return. To go astern the hand wheel is rotated in the opposite direction, and all the cams function in exactly the same manner, with the exception of T, which is constructed to move K and 13 in the opposite direction.

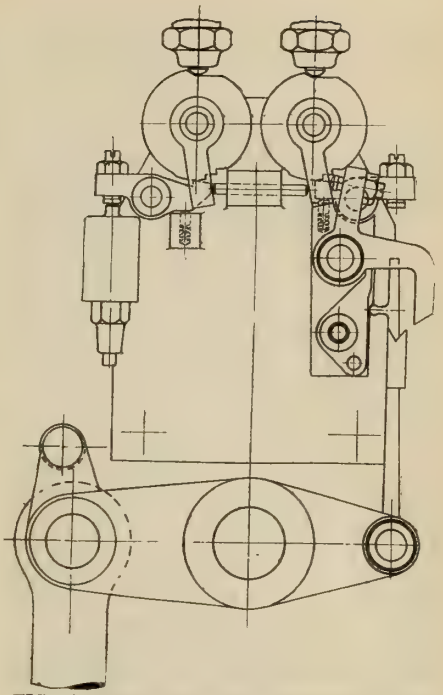


FIG. 4—HIT AND MISS TWO-CYLINDER GOVERNOR.

In the case of two-cylinder engines fitted with reversing gear the reversing lever is interconnected with the governor in such a way that it throttles the engine down before opening the clutch, and thus prevents racing.

These engines are being manufactured with two sizes of cylinders, viz., 270 mm. bore by 300 mm. stroke, and 335mm. by 350mm., grouped according to the power required. The smaller size gives about 30 horse-power per cylinder when running at 340 revolutions per minute, while the larger set develops 50 horse-power at 300 revolutions per minute. The makers say that the fuel consumption is 0.57 lb., 0.517 lb. per brake horse-power per hour respectively.

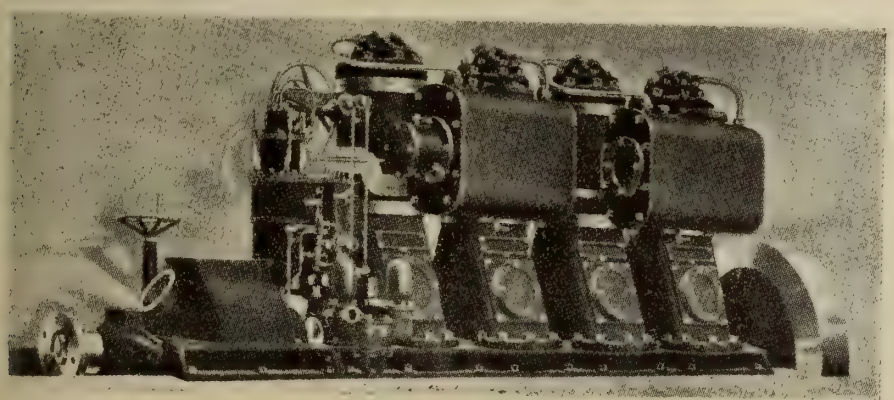


FIG. 3—FOUR-CYLINDER 200 H.P. ENGINE.

cam T, which controls the rack K, and hence the timing of the injection. A cam U, which actuates a locking mechanism to hold E fast when this ring is in the advance injection position. A cam V operates the main air valve Y, admitting air to the starting position. Two of these valves are required, one for ahead and one for astern,

NEW ENGINEERING STANDARDS

The work of the British Engineering Standards Association is still proceeding steadily. At the request of British makers of small tools and of machine tools the Association recently undertook an inquiry into the standardization of milling cutters and reamers. After a very exhaustive study the association issued a report setting out the standards decided upon. Another interesting report from the same body deals with standard specifications for electric cooking ranges. The two sizes standardised are suitable for five persons and ten persons respectively. It may be added that when, quite recently, engineers in the United States decided to arrange for standardization on a systematic plan they adopted the model built up by the British Engineering Standards Association.

World's Shipping Shown by Lloyd's Register

THE new edition of Lloyd's Register Book contains as usual very complete particulars of all the seagoing vessels of the world. In the sail part there are over 5,000 sailing vessels and vessels fitted with auxiliary engines, while in the steam part are recorded some 27,000 vessels. In addition to these bulky volumes many lists of great interest to the shipping community are published in this work, such as: Signal letters assigned to all sea-going vessels; names of shipbuilders and engineers in every country; names, postal and telegraphic addresses of all firms connected with shipping all over the world; full particulars of dry docks, wet docks, and harbors at home and abroad; particulars of merchant steamers capable of a speed of 12 knots and above; names, etc., of vessels built for the transport of petroleum in bulk; complete lists of shipowners and managers, with the names and tonnages of their respective vessels, and many other lists of great practical value. It is no wonder, therefore, that underwriters, shipowners, merchants, and charterers subscribe in their thousands to this work, the most reliable authority on merchant shipping published.

One section of the book which has not yet been mentioned is probably the one of greatest interest to the general public, and that is the statistical tables issued with the new edition. In this connection special attention should be drawn to the notes at the commencement of the tables, which quite clearly explain what vessels are included or excluded from the tables; a most important point when dealing with statistics.

The contents of the several tables which are summarized below will repay a careful study, especially table No. 3, which shows the enormous amount of tonnage holding Lloyd's Register class, but the one of most immediate interest and importance is table No. 1, setting forth the tonnage owned in different countries. This table shows that there are recorded in the new register book (excluding vessels of less than 100 tons) 5,082 sailing vessels of 3,409,377 tons, and 26,513 steamers of 53,904,688 tons, thus making a world's total of 31,595 vessels of 57,314,065 tons gross.

Very interesting points can be ascertained by an analysis of this table and by comparison with similar tables issued by Lloyd's Register in previous years.

Sailing Tonnage

The reduction in sailing tonnage since pre-war time—say June, 1914—amounts to 641,000 tons, which is a much smaller decrease than what occurred in previous periods of six years. This shows no doubt that the shortage of tonnage has to some extent given a new life to the construction of sailing vessels. The United States is the only country which has increased the sailing tonnage since 1914. Over 43 per cent. of the world's sailing tonnage is now owned in that country. It should, however, be remembered that the figures for the United States include a large proportion of sailing barges.

The other countries which still have a considerable amount of sailing tonnage are the British Empire (440,000 tons), France (282,000 tons), and Norway (240,000 tons).

The percentage of sailing vessels to the world's tonnage is now under six per cent. as compared with just over eight per cent. in 1914, and nearly 22 per cent. in 1902, and in view of the present small percentage it will no doubt be convenient if sailing vessels are excluded from consideration of the present relative positions of the various countries.

Steam Tonnage

The following table shows the steam tonnage owned by the principal maritime countries before and after the war:

Country	June, 1914 Tons, Gross	June, 1920 Tons, Gross	Difference between 1914 and 1920, Tons. Gross.
United Kingdom.	18,892,000	18,111,000—	781,000
British Dominions	1,632,000	2,032,000+	400,000
America (U.S.).—			
Sea-going ...	2,027,000	12,406,000+	10,379,000
Great Lakes..	2,260,000	2,119,000—	141,000
Austria-Hungary	1,052,000	.....	.....
Denmark	770,000	719,000—	51,000
France	1,922,000	2,263,000+	1,041,000
Germany	5,135,000	419,000—	4,716,000
Greece	821,000	497,000—	324,000
Holland	1,472,000	1,773,000—	301,000
Italy	1,430,000	2,118,000+	688,000
Japan	1,708,000	2,996,000+	1,288,000
Norway	1,957,000	1,980,000+	23,000
Spain	884,000	937,000+	53,000
Sweden	1,015,000	996,000—	19,000
Total abroad ..	26,512,000	35,794,000+	9,282,000
World's total ..	45,404,000	53,905,000+	8,501,000

It will be seen that amongst the principal countries, apart from Germany, the United Kingdom and Greece are the only ones which show a considerable reduction in the tonnage now owned as compared with 1914. Notwithstanding the increased construction and the large amount of ex-enemy tonnage provisionally allocated to British management, and, of course, included in the figures, there are at the present time some 781,000 tons less of steamers owned in the United Kingdom than in 1914.

Most of the other countries show an increase very considerable in some cases.

The seagoing tonnage of the United States has increased by nearly 10,400,000 tons, an increase of over 500 per cent. on the 1914 figures. The other countries in which the largest increases are recorded are: Japan, 1,288,000; France, 1,041,000; and Italy, 638,000 tons. As in the case of the United Kingdom, the figures for France and Italy include a considerable amount of ex-enemy tonnage provisionally allocated to these countries.

The figures for Germany conclusively show the change in the maritime position of that country. While in 1914 Germany occupied, after the United Kingdom, the first position with over 5,000,000 tons of merchant steamers, only 419,000 tons are now recorded in the book as German, everything else having been either captured, requisitioned, or allocated to the allies in accordance with the peace treaty.

The relative position of some other countries has also altered to a large extent. In 1914 the United Kingdom owned 41.6 per cent. of the world's steam tonnage, the present percentage is 33.6. Norway which occupied the fourth place, is now seventh, while Japan, which was sixth, is now third.

Excluding vessels trading on the Great Lakes of North America (about 2,300,000 tons), the United Kingdom percentage of the world's seagoing steam tonnage has decreased from 43.9 in 1914, to 35.1 in 1920, while the proportion of the United States, which was 4.7 per cent. six years ago, now reaches 24 per cent.

It should be stated that with the exception of the United States most of the increase recorded by the various countries, as compared with 1914, has taken place during the last 12 months, during which period over six million tons of shipping have been added to the world's merchant navies.

Taken together, the Scandinavian countries—Norway, Sweden and Denmark—still show a decrease as compared with 1914 of 47,000 tons.

Summarizing the totals it will be seen that the present position of the merchant steam tonnage as compared with 1914 is as follows:

Estimate of the Tonnage of Seagoing Steel Steamers Which Would be in Existence in 1920 If There Had Been No War.

	Tons
United Kingdom	21,420,000
United States	2,155,000
Germany	6,478,000
Other Countries	21,050,000
Total	51,103,000

These totals, of course, do not take into account the present efficiency of the world's tonnage as compared with 1914.

Without going into details on this subject, it is only right to point out that during the last few years practically no replacement of steam tonnage has taken place solely for reasons of age, while prior to the war a very considerable amount of old steam tonnage was broken up each year.

A question, very interesting, although not of immediate practical value, which has often been raised is what would the tonnage be now if there had been no war?

It will be noticed that of the 54 million tons of steamers in table 1, nearly 50 million tons consist of steel steamers showing thus that for the purposes of comparison between the leading maritime countries the results would really be more accurate, from the point of view of international trade, if only steel steam tonnage were taken into account.

No doubt many intricate points are involved in making a close estimate, nevertheless the results of a careful attempt on this subject, based upon seagoing steel steam tonnage, apart from efficiency, i.e., age, size, speed, etc., may not be without interest.

Eliminating, therefore, iron and wood tonnage and all vessels trading on the Great Lakes of North America, and assuming that the ratio of increase during the period 1914-1920 would have been about four-fifths of the average ratio of increase which took place during the previous six years, which period, as it happens, included three poor years (1908-1911) and three good years (1911-1914), the result is as follows:

	Tons
United Kingdom	18,500,000
United States	10,992,000
Germany	375,000
Other Countries	17,720,000
Total	47,587,000

To obtain figures regarding the actual tonnage owned at present which could be correctly compared with the above estimate it will be necessary to take into account the considerable amount of ex-German tonnage which, the allocation of it not being yet known, is included in table No. 1 under "Flag not recorded." Presuming that such tonnage will be allocated in somewhat similar proportions to what has taken place up to now, the figures for tonnage owned at present shown in table No. 1 could be summarized as follows:

United States, a gain of	8,837,000
United Kingdom, a loss of	2,920,000
Germany, a loss of	6,103,000
Other Countries, a loss of	3,330,000
Total loss	12,353,000
Net World's Loss	3,516,000

The difference, therefore, between the latter figures and the estimate of what would have occurred but for the war is as follows:

	Tons
Decrease in the United Kingdom	781,000
Loss to Germany	4,716,000
Total	5,497,000
Increase in the United States	10,379,000
Increase in other Countries	3,619,000
Total	13,998,000
Net World's increase	8,501,000

Dealing only with these figures apart from the question of efficiency, the result appears to be that notwithstanding the great expansion in the shipbuilding industry, the world, as a whole, is still about 3½ million tons of steel steam tonnage to the bad as compared with the above estimate.

As regards the United Kingdom, in which country during the war merchant shipbuilding had to take second place, and which after the war has transferred so many vessels to other flags, the present totals show a decrease of nearly three million tons of steel steamers as compared with what could reasonably have been expected but for the world war.

On the contrary, in the United States the increase during this period has been such as to bring the total tonnage of seagoing steel steamers actually equal to the combined totals of the principal European maritime countries mentioned in the above table (other than the United Kingdom).

UNSOLVED PROBLEMS OF THE SEA.

Closing entries were posted this week at Lloyd's against two sailing vessels and one steamer of which no information had been received for a considerable time. The vessels were the Norwegian sailing ship *Fulwood*, the Portuguese schooner *Madrugada*, and the French steamer *Vidauban*.

With regard to the first-named vessel, which was of 2,176 tons gross and built in 1885, no news of any kind has been received of her since she left Buenos Ayres for Korsor on Nov. 6, 1919, a period of 335 days up to Oct. 6.

It will be remembered that a couple of months ago a report was published in "Lloyd's List" of a Norwegian barque, the *Skansen I.*, having been observed by a diver sunk in the minefield at Hertha Flak, off the Skaw. A parallel case, to which attention was drawn at the time, was that of the Swedish ship *Ernst*, the wreck of which was located in the north-east minefield of Hertha Flak, in May last.

There is no authority for suggesting that a like fate has befallen the *Fulwood*, but the possibility of such an occurrence must be borne in mind in view of the fact that the latter stages of her voyage would like in the region in which the other disasters took place.

In the case of the *Madrugada*, which is an ex-American schooner of 189 tons gross, built in 1868, no news had been received since the vessel sailed from New York for Oporto on Dec. 29, 1919.

The third vessel, the *Vidauban*, left Mostaganem, Algiers, on March 12 of this year for St. Louis (Rhone). About 10 days later patrol vessels from Toulon and an airship set out to search for the *Vidauban* and another steamer (the *Lux*) which was also overdue. On April 6 one of the tugs returned to Toulon with wreckage belonging to the *Lux* and one of the boats of the *Vidauban*, which had been found near the Balearic Islands. Further search proved fruitless, and the *Lux* was posted at Lloyd's as "missing" on May 12. Nothing further having been heard of the *Vidauban*, she is now presumed to have been totally lost, with 25 persons on board.

THE DEVELOPMENT OF UNITED STATES PORTS

Steps will probably be taken at the next session of the United States Congress to urge the passage of legislation whereby all tonnage taxes collected on foreign vessels entering American ports shall be devoted to the development of the ports and harbors of the United States. One of the leading advocates of this method of improving shipping facilities is W. S. Linsolm, Commissioner of the port of Seattle, who points out that 200,000,000 dols. has been spent in the development of the Port of London, 125,000,000 dols. on Liverpool, and 100,000,000 dols. each on Manchester and Hamburg. In America the burden of port development has been placed almost entirely upon local communities with little aid from the Federal Government. The proposal to set aside tonnage taxes collected from foreign vessels coming to United States ports for the development of those ports rests upon the principle that natural harbors are great national service stations. Neither a great water transportation system nor a great rail transportation system will be effective in building up foreign trade, says Mr. Linsolm, until the port facilities are commensurate with the magnitude of the rail system and the water system of transportation. Great Britain has been the great trading and maritime nation in the world. It has recognised its harbors as national assets of great importance. To solve the problem of how hundreds of millions of dollars should be obtained to develop these ports the English statesmen arrived at these conclusions:—"We will build the finest and best-equipped piers and ocean terminals in the world. We will invite the foreign ships to these harbors, but we recognise it to be right that these ships using our terminals should pay a tax to the British Government, and the money so collected should be used in improving the port terminals, thus making our ports more and more efficient and more and more attractive to the shipping interests of all countries." If the United States are to compete with Great Britain it seems to Mr. Linsolm the part of wisdom to profit by what she has learned from a much wider and broader experience in world-wide shipping than the United States have had.

Victoria, B.C.—The old cruiser "Rainbow," sold recently to Neider and Marcus, of Seattle, Wash, is to have the machinery taken out of her and will be used as a barge for the transportation of ore from the north. The work of converting the "Rainbow" into an ore hulk will be done at the Seattle plant of Neider and Marcus. It is calculated she will carry 3,000 tons of ore as a barge.

Service Experience With Marine Condensers

Some of the Results of Naval Experience With Condensers, and Their Inherent Troubles, Are Discussed in This Paper Read Before the Institute of Metals.

By LIEUT.-COMM. G. B. ALLEN, R.N.

THE importance of the elimination of condenser defects has been recognized in the navy for many years, and as this question is assuming an increasing degree of prominence in the mercantile marine and land installations, it is hoped that some remarks on service experience may be of interest and some value.

In the early days of low powers and comparatively high ratio of machinery weight in war vessels, a high standard of purity of feed water was not absolutely essential, and owing to its protective qualities a certain amount of boiler scale was not particularly objectionable. Under these circumstances the boilers were frequently worked with a slight density, and the admission of small amounts of salt water to the feed was a matter of no great moment, and indeed would not ordinarily be detected.

Further developments in the direction of greater horse-power per unit weight of machinery required the attainment of the maximum boiler efficiency compatible with the type of boiler then employed, and the presence of any non-conducting scale upon the heating surfaces could no longer be tolerated. A high standard of purity of feed therefore became essential and condenser defects, hitherto unnoticed, became more and more apparent. Subsequently the demands for maximum power on a minimum weight necessitated the development of the water-tube boiler, which in its present form is peculiarly sensitive to the quality of feed supplied, and a condenser defect which formerly would have been regarded as of little importance is now attended by results which are out of all proportion to the magnitude of the defect itself.

Among the immediate results following upon such a defect as a small perforation are:

(a) A rise in the density of the boiler water followed by priming (i.e., the passage of water with the steam through the system), with consequent possible damage to fast-running reciprocating auxiliaries, and undue wear (erosion) of turbine nozzles in modern vessels; and unless the evaporation is considerably eased, and the engines either slowed down or stopped, the mechanical damage caused by the water passed over may be very considerable.

(b) The deposition of scale upon the heating surfaces.

(c) The commencement of serious corrosive action in the system, including both boilers and turbines, the first-named being particularly severe in the highly forced boilers of the present day.

It is on these grounds, both of reliability and durability, that the importance of maintaining a pure "feed" rests.

Fortunately the proportion of defective tubes compared with the number of tubes on service is extremely low and is not greater than 50 in 1,000,000 per annum, but if it be realized that in a large vessel fitted with some 48,000 tubes of a total length approximating to 115 miles, such a small defect as a 1-16 in. diameter per hole or one cracked tube may render the vessel unmanageable in a moment of great stress, it will be evident that it is a matter of great importance to secure immunity from such defects, and, moreover, one which requires considerable investigation and joint co-operation between the manufacturer, the metallurgist and the user.

Many of the early difficulties experienced were found to be due to faulty design and manufacture, but these, which concerned accuracy of fitting rather than faults in the tubes themselves, have been gradually eliminated. Defects of this nature may be summarized as follows: (1) Insufficient support of tubes between the tube plates; (2) holes in diaphragm plates too large; (3) holes in tube plates too large or too small; (4) unsuitable packing; (5) slackness of ferrules in tube plates; (6) steam or drain orifices unsuitably placed, allowing steam and hot water, sometimes contaminated with oils, to impinge on certain tubes.

Insufficient support led to undue vibration of the tubes, and although this has been largely rectified by the provision of suitable and unequally-spaced diaphragm plates, and by limiting the diameters of the tubes and the holes through which they pass, a certain clearance must of necessity be allowed; and the effect of vibration, more especially in high-speed vessels, cannot be ignored.

Experience has shown the necessity of adhering to rigidly-defined limits in regard to the tolerances of tubes and holes in tube plates, both on the score of guarding against the fit being too close, with consequent abnormal strain thrown on the tubes when screwing up the glands, and also of guarding against too loose a fit, resulting in the packing being forced between tube and tube plate and probable leakage. Similarly, the exact concentricity of ferrules and tubes within narrow limits is of importance. Since the adoption of limiting clearances, defects of this character have to all intents and purposes been eliminated.

Opinions concerning the suitability of packing materials vary, and outside the service there appears to be little uniformity of practice. Experience in naval vessels shows that the linen gromet made to present Admiralty specification gives every satisfaction, and with ferrules and their stuffing-boxes screwed to correct gauge, difficulties due to gland leakage may be regarded as having been coped with successfully.

Investigations into the general problem of the nature of the underlying causes of corrosion within the alloy itself have resulted in various theories, none of which have as yet met with general acceptance, and in the present stage the most we are able to do is to endeavor to trace each defect to its immediate observable source. In many cases this is possible and a fairly simple matter; but in others, such as may be covered by the description "general corrosion," considerable difficulty may be experienced. Fortunately such cases are comparatively few, and though it may be argued that this comparative freedom hardly justifies the necessary expense and trouble of further investigation, yet from naval considerations it is just these few cases for which remedy must be found.

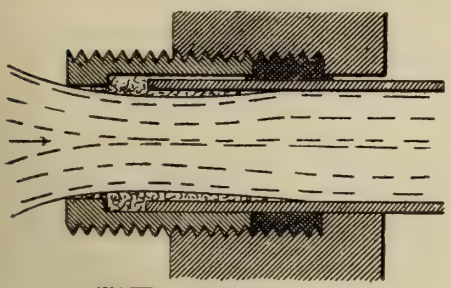
The information available at the Admiralty is derived from reports forwarded by ships as failures occur. Owing to the conditions of service during hostilities it has been impossible to obtain complete records of all failures received since the cessation of hostilities, the following statement has been deduced to show the present causes of failure in the proportion in which they have occurred.

	Per cent. of Total Failures
(a) Deterioration at inlet ends	18.0
(b) Perforation due to local pitting	14.8
(c) Perforation due to obstruction	14.8
(d) Perforation due to steam impingement	5.4
(e) Crushed ends	5.4
(f) Splitting	10.8
(g) Perforation due to contaminated circulating water	1.0
(h) General corrosion	29.8

The large proportion of failures due to the deterioration at the inlet ends of the tubes is noteworthy. Generally speaking there is a marked thinning away at the ends of the tubes (not infrequently accompanied by wear of ferrules) culminating in perforation at from 1 to 3 inches from the end.

In many cases where the greatest intensity of the deterioration occurs at the upper inside surface of the tube, the presence of air has been held to be the chief contributory factor, and under such circumstances the provision of air-releasing

devices at the highest point of the circulating water system has proved of marked benefit. However, with all such mechanical precautions, the evacuation



WATER ENTERING TUBE.

(before entry to the tubes) of air which is necessarily in suspension in the circulating water is at the best only partial. This is more especially the case in high-speed shallow-draught vessels, and as will be evident from an examination of Fig. 1, the sharp edges both of ferrule and tube, assisted to some extent by the possibility that the tube and ferrule may not always lie perfectly concentrically, tend to break the flow of water and to form pockets of an unstable nature where air may be reasonably expected to accumulate.

This type of defect has been particularly noticeable in vessels serving in shallow waters containing a considerable proportion of solid matter, e.g., sand, chalk, etc., and this, together with the comparatively high-water velocity through the tubes, points to the influence of erosion, or the abrasive action of gritty particles, as being of considerable importance. The presence of such gritty matter cannot of course be avoided on service, and it appears that investigations with regard to the elimination of this type of defect must take the lines of endeavoring to obtain a metal whose surface is better able to withstand this abrasive action.

Whereas in the cases of tube-end deterioration the number of tubes affected in any condenser (apart from those which actually fail) may be considerable; cases of local pitting are rarely evident in more than one or two tubes in the condenser concerned, and when once a failure has occurred and the tube plugged or replaced, little further trouble is experienced. In these cases perforation occurs at isolated spots, and the failure has been generally considered to be due to some local defect, e.g., a spill or lamination. To quote the author of a previous paper on this subject, "The importance of spills cannot be exaggerated," and the elimination of defects of this character is entirely a question of the manufacture of the mechanically perfect tube, which desirable result can only be obtained by the drawing down of a mechanically perfect cast shell. The practice of turning and boring each shell, even if regarded as merely for purposes of exploration of the metal immediately beneath the surface skins, has a considerable safeguarding effect toward the reduction in the number of such surface irregularities as may be discovered on sighting.

Perforations, the cause of which has been directly traced to obstructions, were particularly prevalent in coal-burning ships where the ashes were discharged beneath the water-line, and though it is possible to nullify the effect of a vessel's own refuse by suitably placing the ash shoots and by the adoption of oil-fuel firing, yet such obstruction of tubes by cinders, etc., may still be caused by refuse from other vessels.

The recorded cases where failure has occurred through the impingement of steam and water directly on a limited area of the outer surface of certain tubes are few, and in general have been confined to condensers other than those of Admiralty design. Such failures should not occur, provided that orifices are suitably placed and baffled.

The proportionate number of failures due to crushing is small, and these may be regarded as isolated cases. In no case has it been established that overtightening of screwed glands has been resorted to, and the fact that crushing sometimes does occur, serves to emphasize the importance of the tubes being sufficiently hard to stand a reasonable margin of pressure due to tightening up above that absolutely necessary to secure watertightness, though it may be remarked that crushing is sometimes observed as a natural result of the weakening of tubes which have been attacked internally by corrosion of a general nature.

There is some divergence of opinion as concerning the most desirable degree of purity of the 70 : 29 : 1 alloy, but investigation has shown that a large proportion of the tubes which have failed from splitting have been manufactured from materials of a lower standard of purity than that required by the Admiralty specification.

Apart from the question of purity of constituents, the internal condition of stress in the finished tube must have considerable bearing on the liability to season cracking and splitting. The work done during the final draw (which must be such as to leave the tubes sufficiently hard to stand the test of grometing) of necessity leaves the material of the tube in an indeterminate condition of internal stress, and anything that can be done which will eliminate this internal stress, while at the same time allowing the tube to retain the requisite hardness, will be of great benefit in minimizing defects from this source.

The case in which failure has been directly ascribed to the use of unsatisfactory circulating water is exceptional, but it certainly gives weight to a widely-held opinion that the conditions under which many condensers are worked in the early stages of their life (e.g., in comparatively stagnant fitting-out basins contaminated by various kinds of refuse) are conceivably of importance as a primary cause of tube decay. On the occasion referred to the vessel had been anchored in waters contaminated by sewage, and the case is quoted as emphasizing that materials for marine usage should be able to resist corrosion under varying conditions which do not allow of the selection of particular materials to suit particular waters. The deleterious effect of vegetable oils has already been described before this institute, but the writer is not aware of any experiments having been carried out to determine the effect of oil fuel in regard to the acceleration of corrosion; though it may be remarked that in one of H.M. vessels which reported a considerable number of defective tubes within two months of entering into service, no definite cause could be traced beyond that extended basin trials had been carried out in comparatively stagnant water contaminated by a considerable leak from one of the ship's tanks.

The proportionate number of recorded failures due to general corrosion does not adequately express the importance of this class, these being cases of actual failure only, i.e., general corrosion culminating in perforation; whereas the great majority of cases in which general corrosion is present are not recorded, and it is the possibility of failure at an unknown moment which gives this matter so serious an aspect.

Leakage from electric circuits has been put forward as being a contributory cause of corrosion, but though no evidence of a positive character has been obtained in support of this contention, it has been observed that failures have occurred shortly after the discovery of "earths," and it is probable that the effect, if any, is one of acceleration rather than a primary cause.

The general problem of corrosion of condenser tubes may be conveniently regarded from four different standpoints: (1) The arrest or prevention of corrosion in condensers as at present constructed; (2) the treatment of tubes of accepted composition; (3) the general design of condensers; (4) the utilization of more suitable alloys than those at present in use.

The provision of steel protector plates and cast-iron water ends has proved satisfactory in checking the rate of deterioration provided that good connections are secured, but at the same time considerable wear of the cast-iron ends takes place, and this wear, if excessive, is a very undesirable feature. The present Admiralty practice is to make the tubes and tube plates of as nearly the same composition as is practicable, and to secure steel slabs direct to the tube plates, but from the foregoing remarks it cannot be said that this practice is entirely effective.

The Cumberland process has been fitted in certain vessels, but beyond the fact that it has been found that this process has not arrested decay where such

decay has been in evidence before the process has been installed, the experience gained has not been sufficient to allow of any reliable conclusions being drawn.

With regard to the treatment of working tubes, the Admiralty (acting on a well-known and successful practice of coating corroded copper pipes with a film of pitch and marine glue) have experimented with resistant varnishes. In the first vessel treated, although a certain degree of protection was obtained, it was found that, probably as a result of the erosive action of the water (but possibly on account of the difficulty of forming a film of even thickness and of satisfactory drying), the varnish became washed away in places, thus exposing portions of the bare metallic surface to the action of the water. Experience with a second vessel has not been extensive, but it is understood that general corrosion which formerly resulted in comparatively frequent failures has been entirely arrested. In these cases the varnish has been applied to the tubes "in place" and dried by the admission of steam to the condenser, and it is probable that such a process carried out on tubes before being fitted would be of considerable value, provided that the surfaces formed withstand the work of fitting in place and prove sufficiently resistant to abrasive influences.

The protective value of an oxide film has been suggested by a former report of the corrosion committee, and the Admiralty have under observation a vessel fitted with tubes on which such a film has been formed; unfortunately this vessel has done very little steaming and no useful data have as yet been obtained.

In regard to the elimination of failures caused by surface defects, e.g., spills, a vessel has been fitted with compound tubes made on the lines suggested by Sir Charles Parsons, but here again, owing to post-war conditions it has not been possible to obtain any conclusive results.

The general design of condensers has been found to be closely connected with tube defects, or rather with the acceleration of deterioration, and in particular in regard to certain designs where the whole of the tubes are not drowned. In these designs a few of the upper rows of tubes which are situated above the water-line have been observed to be particularly prone to corrosive action, and consequent upon the general thinning this action is not infrequently accompanied by "end crushing." Generally speaking, the design must of necessity be prepared with regard to the space and position available in the ship, and under the present conditions the approximately horizontal position must be accepted as inevitable. In very early designs vertical tubes have been employed, but in such cases where it has been necessary to arrange for outside circulation the lower surfaces of the tubes have been found liable to deterioration. The present practice is to allow the circulating water to pass through the tubes, and it may be noted that the alternative method of outside circulation not only does not lend itself to a suitable engine-room arrangement, but is undesirable on account of the difficulty of providing access for cleaning.

The Admiralty have from time to time experimented with tubes of various compositions, but experience to date has shown that the tubes made to Admiralty specification have proved the most satisfactory under the varying conditions imposed by naval service. With every precaution taken during manufacture, and with the adoption of any known preventive or protective process, it must be admitted that freedom from deterioration cannot be guaranteed, and it appears that complete immunity, or at least a guaranteed life, can only be obtained by the employment of an alloy other than a simple brass.

THE NAVY LEAGUE PROGRAMME

Canadian ships sailing to all parts of the world carrying Canadian goods and manned by Canadians is the slogan of the Navy League of Canada in their effort to raise $760,000 in a national campaign for the relief of merchant sailors' widows and orphans, the training of Canadian boys, to help sailors' institutes, and for the development and administration of the movement.

The Navy League of Canada deprecates the fact that Canada has fallen back in maritime power. Seventy years ago she stood in third place, and her ships were manned by Canadians. To-day she is the eighth power. The league plans to have the ships sailing from Canadian ports manned in the future by young Canucks, and thus boosting the Dominion the world over.

Statistics compiled show that it takes six times as long to train a seaman as it does to build a ship. Maritime strength cannot be achieved in a year or even a decade. Its growth can only be commensurate with the development of a sea-conscious spirit in the nation.

The continuous training of over 2,000 Canadian lads in the boys' naval brigades of the Navy League of Canada is having an effect upon our maritime future.

There are 8,700 ships under the Canadian flag to-day with a personnel of 45,000. The value of the merchant fleet is in money $250,000,000. Lack of interest on the part of Canadians our maritime affairs has allowed the command to drift into other hands. Our ships are neither officered nor manned by Canadians. The burden of the British navy is $17 per head of the British taxpayer, while Canadians escape with 25 cents.

The Navy League of Canada maintains that new routes must be opened, trade lines established and maintained. Commercial supremacy means the ability to carry when and where required, to sell without interference, and demands the freedom of the seas.

ELECTRICAL EQUIPMENT OF SHIPS

Standard Specifications

A general adoption by ship owners of two recently issued standard specifications of the British Engineering Standards' Association should make for economy and efficiency in the maintenance of the electrical equipment of ships, and what is of even greater importance, an increased measure of security for the preservation of the intactness of watertight decks and bulkheads upon which the safety of a ship when damaged often largely depends.

The specifications deal respectively with watertight glands for electric cables and watertight fittings for incandescent electric lamps. Their primary object is to secure the interchangeability of all parts exposed to the risk of being broken or injured, by standardizing certain dimensions for these parts, and the positions of all securing holes for attachment of the parts to the ship's structure, and the provisions of the specifications are intended to include all the technical requirements necessary for supply of the various parts to this end.

In the case of the fittings for lamps the realization of this object has practically standardized the entire design of these fittings, a point that the association realized called for most careful consideration. In their opinion, however, this should in no wise prove detrimental to the interests of either the makers or users.

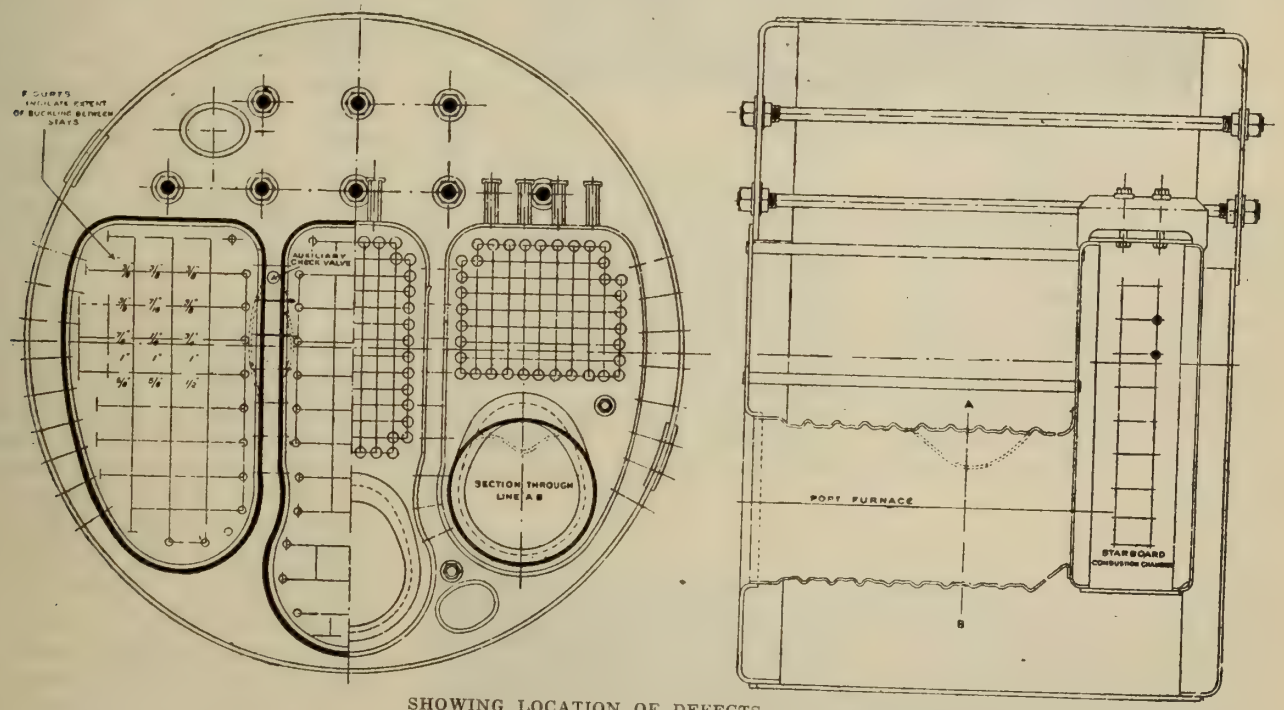
Two types of fitting, the bulkhead or oyster type, and one convertible at will into a long or short pendant, or into a bracket, are dealt with in the specification for lamp fittings, and two sizes for each type are provided for. The whole range of requirements for metal filament vacuum lamps with consumptions up to 30 watts, or between 30 watts and 60 watts, and for carbon filament lamps with consumption up to 60 watts, or from 60 watts to 120 watts, are completely covered.

The provisions of the specifications for watertight glands standardize simple forms of glands for decks and bulkheads, and for cast metal and sheet metal boxes, providing six sizes for each type. Screw threads throughout are specified to be of British standard, Whitworth form.

Both specifications have been drawn up at the request of the Ship Electrical Committee of the Institution of Electrical Engineers. They may be obtained from the offices of the British Engineering Standards Association, 28 Victoria Street, London, S.W.1; price 1s. 2d. each, post free.

Accidents to Scotch Marine Boilers

THIS report of enquiry under the Boiler Explosions Acts indicates the risk due to oil sediment deposit within the area of the heating surface and refers to an explosion from the port main boiler of the steamship "Willaston." The vessel was fitted with three single-ended boilers 15 ft. 6 in. diameter by 11 ft. 10 in. in length, each having three corrugated furnaces, 3 ft. 6 in. diameter, with separate combustion chambers, pressure 180 lbs. There was no donkey boiler. The port boiler, after being examined in April, 1919, was used during a voyage to Montreal and in port for auxiliary purposes till arrival in London on 5th July, 1919, when the fires were allowed to die out and the centre boiler was used in port. Ten days later the fires were again set away and when steam was ready this boiler was used as the auxiliary on the day before sailing from London on July 17th, when the steamer left at 3 a.m. with the gauge glasses showing nearly full up. At about 8 a.m. something went wrong with the port boiler, and the stokehold became filled with steam and dust. The chief and second engineers then tried to reach the boiler tops, but the steam drove them back at each attempt, the safety valves were eased and the engines opened out to full speed; when the steam was reduced the vessel was anchored. It was then found that the port furnace had collapsed near the tube plate end, and evidently the starboard chamber was leaking badly. It was resolved to return to London, where the boiler was carefully examined, when the wrapper plates of the centre and starboard chambers were found bulged, in addition to the port furnace damage. The demands on the steamer were such that time did not admit of the repairs being carried out then, and she sailed for Canada with the port boiler out of action. On her return a thorough investigation of the port boiler was made. The starboard and centre chamber wrapper plates were found to be bulged in from the top row of stays down a distance of about 2 ft. 4 in., the starboard chamber damage being the more severe. The flanges of the combustion chamber back plates were also set in. The starboard chamber plate had been forced over the stays, hence the serious leakage. The port furnace was pocketed about 9½ ins., starting from the back corrugation and embracing four corrugations. The heating surfaces generally were found comparatively free from scale, with no sign of corrosion on plates or stays. Careful examination of the damaged wrapper plates showed distinct signs of overheating, these being most pronounced on the starboard chamber, and there was on the right side a thin deposit of a black powdery substance. The auxiliary check valve is fitted 15½ ins. below the combustion chamber crown, on the back of the boiler between the centre and starboard chambers; no internal feed pipes are fitted, but the chest opening projects about 7 ins. into the boiler with a closed end, and having four rectangular ports on the upper circumference through which the feed flows. An auxiliary condenser is fitted and the feed pump draws from it in port. It appeared from the position of the damaged plates relatively to the check valve that the feed water would be discharged so near that any greasy sediment would be deposited thereon, and the probability is that this is what happened and caused the damage. An analysis of the black deposit found on the plates confirmed this view. The deposit acting on the water side of the plates led to overheating and brought about the collapse. The damage to the furnace was due to the sudden outlet for the water at the combustion chamber plates fractured at the stays, leading to shortage of water on the furnace crown. The inquiry was conducted by Mr. A. H. Longstaffe, Board of Trade surveyor.



SHOWING LOCATION OF DEFECTS

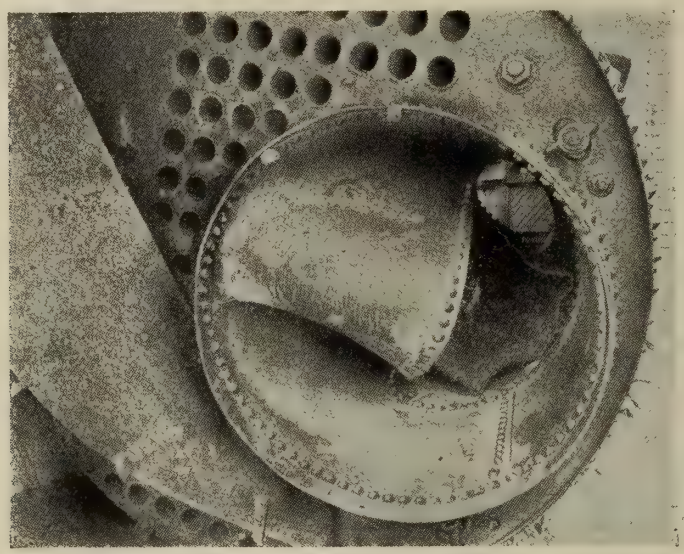
NEW METALS IN SHIP PROPULSION

A very significant hint was thrown out by the chairman of the Institute of Metals at a recent convention of that body. He pointed out that while the internal combustion engines used to drive merchant ships contained only 3 per cent. of metals other than iron and steel, the driving equipment of the latest British submarines (oil engines, steam turbines, and electrical machinery combined) showed a proportion as high as 37 per cent. Therefore the marine engineer would find in naval practice suggestions for increasing power and reducing weight by using some of the wonderfully strong yet light alloys which British metallurgists had developed.

EXPLOSION OF A SCOTCH MARINE BOILER

From "Travellers Standard"

Boilers of the Scotch marine type are widely employed in Great Britain, where they are considered to be reasonably safe and economical. They have never been extensively used in American land practice, although they are by no means unknown in this country, and in some sections they are frequently met with. Occasionally one of them fails, and the accompanying illustrations show some of the damage that resulted when an accident of this kind occurred recently. The fireman, who was the only person about the boiler house at the time, was killed, and the property loss amounted to about $7,000.



THE RUPTURED FURNACE.

The boiler that exploded was No. 2 of a battery of two boilers of similar type and size, which were installed in the plant of the Detroit Creamery Co., at Owosso, Mich. Each boiler was 90 inches in diameter and 13 feet 3 inches long. Each had a single furnace, 47 inch in diameter and 12 feet 10 inches long, composed of five sections of steel plate, each ⅜ of an inch thick and about 30 inches long. The furnaces were of the plain type—that is they had no corrugations or stiffening rings or flanges—and the girth and longitudinal seams in the furnaces were of the single-riveted lap-joint type.

The explosion occurred at about 5.30 p.m. on June 17. The furnace of the boiler failed by collapsing throughout its entire length, and by rupturing the first girth seam. About half of the rivets sheared, and the metal in the plates pulled away from the rivets in the remaining part. The rupture extended about 39 inches around the top of the seam, and the upper part of the front course of the furnace was pushed down and forward.

WHERE THE BOILER LANDED.

The fireman was blown across the river and against the wall of an old packing plant—a distance of 500 feet or more. The boiler was thrown some 600 feet in the opposite direction, and struck the rear end of a residence. It moved the house at least a foot on its foundation, crushed a woodshed, and damaged two other houses and a near-by automobile. The boiler house was destroyed, and boiler No. 1 was moved out of position. The steel stacks on the boilers were tipped over upon the creamery building. The boiler shell was not materially injured, and can be put in service again after new tubes and a new furnace have been installed. Examination of the boilers after the accident led the investigators to believe that low water was the primary cause of the explosion. The metal showed evidence of overheating, and there was also testimony to the effect that water was being introduced into the boiler at the time of the accident. The mode of failure also tends to confirm the low-water theory, because the first girth seam, which was in the hottest part of the furnace, would be first affected.

The boilers were constructed and installed in 1913, and at that time plain furnaces were quite commonly used. This construction is not favored at present, however, and would not be accepted for the pressure under which these boilers were operated (namely, 85 pounds) in localities where the A. S. M. E. code, or some other similar code, is in effect. In fact, the A. S. M. E. code limits the diameter of an unstayed furnace of this kind to 38 inches.

NEW BULLETIN

The Hays automatic CO_2 and draft recorder is described in a new bulletin just issued by the Jos. W. Hays Corporation, Michigan City, Indiana. The bulletin describes fully the unpacking, erecting, pipe layout, and operation of the recorder. It is well illustrated, and a diagram of spare parts, numbered to correspond to a spare part index, is included. This is a very useful little book for all users or prospective users of these instruments.

George W. Cole, Ltd., Toronto, have issued a new bulletin descriptive of their steam traps and steam trap installations. Diagrams and illustrations of actual installations are given, and line drawings of the operating features of the trap included. The bulletin also illustrates heaters, check valves, radiator valves, etc., handled by the firm.

CATALOGUE

The Armstrong Cork and Insulation Co., Pittsburgh, have issued catalogues descriptive of their Cork Tile for flooring purposes, also their Linotile floors These catalogues are well illustrated in colors, and the different applications of the flooring specified.

Dominion Motor Castings, Ltd. Incorporators: Clifford Albert Ripley, manufacturer; and others, all of Detroit. Capital $250,000. Head office, Windsor.

What They Think of Our Merchant Fleet

The Following Article is Reprinted from the Columns of the "Observer," a London Daily Newspaper, and Was Contributed to Them by Their Special Shipping Correspondent.

THE Canadian Victor, an opportunity of visiting which ship at Liverpool was afforded me on Friday, is a new single-screw cargo steamer of 5,454 tons gross and 3,340 tons net, with a dead-weight tonnage of 8,400. Built by Canadian Vickers, Ltd., at their Montreal shipyard, the latest addition to the fleet of the Canadian Government Merchant Marine, Ltd., is noticeable for the excellent accommodation provided for the officers and crew, accommodation which is well in advance of B.O.T. regulations.

The maiden voyage of the Canadian Victor is noteworthy for two reasons. In the first place she is an extremely well designed and staunchly built vessel, which is the product entirely of a Canadian yard, of Canadian steel mills, and of Canadian engine shops. On board of her will be found many engines and much equipment well known on this side, but it has all been manufactured under licence in Canada, and compares well with the best produced on this side of the Atlantic. The war gave Canada an opportunity to establish a permanent shipbuilding industry, and excellent service was rendered to the Empire by the Dominion yards, both in the way of new production and of repair work. The future of the industry was for a time in doubt after the close of hostilities. The Canadian Government have very wisely recognised the actual and potential values of shipbuilding to the Dominion, and both by encouraging legislation and by orders for new tonnage have enabled the industry to be placed on a firm and permanent peace time footing, as may be judged from the fact that to-day there are more vessels building in Canada for foreign account than in the whole of the United States.

A Policy of Co-Operation

Secondly, the maiden voyage of the "Canadian Victor" is noteworthy because the agents of the vessel at Liverpool are the Cunard Co. The importance of that fact is that in it lies the secret of the policy of the Canadian Government in regard to shipping. That policy is, at present at all events, the development of Canadian trade by the creation of new trade routes from Canada rather than by competition with the old lines. It is recognised that to the great private companies, who have ventured and risked, the prosperity of the Dominion has been due in the past, is due in the present, and the Government looks to them for similar assistance in the future. In shaping its shipping policy, therefore, it has decided on co-operation—not on competition. It is for this reason that we find the Cunard in Great Britain, Alfred Holt and Co. in the Far East, the British India Steam Navigation Company in India, acting as agents for the Canadian Government Merchant Marine Ltd. Another point worth noting is that this Dominion-owned fleet—sixty-six steamers ranging from3,800 tons d.w. to 10,800 tons d.w. have been ordered, and thirty-six are already in operation—is a limited liability concern. It has a fixed capital, it is managed on business lines, and the State is not responsible if it makes a loss. That is a very great point and differentiates the Canadian Government's shipping venture from any other State-owned fleet.

Lines in Operation

Perhaps nothing was proved more clearly by the war than the vital importance of shipping to countries of all denominations, but perhaps most particularly to countries outside the actual area of operations. Neutrals having no tonnage of their own had to depend on the belligerents for whatever cargo space could be spared them—or put up the shutters. This has been a lesson to many of the Dominions also. Canada found herself dependent largely on American shipping. The Canadian Government Merchant Marine, Ltd., is a deliberate and well-conceived effort to salve a large proportion of Canadian commerce from American carriage. Lines are already in operation from Canada to Liverpool, London, Glasgow and the Bristol Channel; to the Indian Empire; to Australia; to the West Indies, the links with which are very old and very strong; and shortly lines to South Africa and the Far East will be running. Certainly Canadian-built ships, carrying Canadian cargoes under the Canadian flag, are a great demonstration of the vitality and determination of our kinsmen across the Atlantic. The fact that this fleet is being operated in alliance with our own great shipping lines is evidence enough that Canadian statesmen are animated by sound instinct and wise precaution.

SHIPBUILDING IN GERMANY

A certain amount of new merchant shipbuilding is being carried on in Germany at the present time. It is uncertain, however, remarks the "Glasgow Herald," having regard to the decline in new orders in Great Britain and in other countries on the one hand, and the abundance of idle tonnage which exists on the other, whether any considerable tonnage is being undertaken in Germany for allied account under the provisions of the Treaty of Peace, and under which the Germans can be required to deliver up to 1,000,000 tons to the allies in a period spread over a period of five years. In fact, it would only be necessary for the allies to call for the particular tonnage in question in order to impart that special stimulus to the German shipbuilding industry of which it stands so greatly in need. Apart from the shipyards which existed in Germany before the war and the extensions which were made during hostilities quite a number of new shipbuilding companies have been formed during the past five years. In this connection a German newspaper gives a list of no fewer than 11 companies which have been constituted in this period at Hamburg, Stettin, Lubeck, Nordenham, etc.; and although the share capital of each individual undertaking is inconsiderable, a large expansion is possible provided that orders can be obtained in addition to those ship orders already on hand. The question of procuring an adequate quantity of ship plate, sections, etc., is naturally an important matter; but, besides the materials received from home iron and steel makers, a company was recently formed at Hamburg with the co-operation of various interests for the importation of materials from the United States, and materials have already been ordered for delivery to yards at Bremerhaven and Geestemunde, while reports are in circulation that attempts are being made to obtain supplies of Japanese steel. Naturally the actual development of the shipbuilding industry when entirely free from restrictions will solely depend upon the ability or otherwise of Germany to obtain a sufficient supply of steel and other materials to occupy the yards. At the same time, and bearing in mind this reservation, it is calculated that the industry has in prospect the certainty of great activity for several years forward in connection with the restoration of the merchant fleet, despite the fact that the present output capacity may be estimated at 1,000,000 tons per annum, as compared with approximately one-half of this tonnage in 1913.

NEW CATALOGUE

The Armstrong Bros. Tool Co., Chicago, Ill., have issued a new catalogue, B 20. This catalogue embodies and makes effective various changes in list prices, and it is suggested by the concern that all previous lists be destroyed.

The book contains 143 pages of real live information regarding their varied line of tool holders, boring tools, lathe tool sets, grinding holders, rachet drills, C clamps, ordinary clamps, lathe dogs, wrenches, etc., etc.

For the convenience of the automotive trade they have segregated a special section devoted to drop-forged wrenches for automotive use. A copy of this book may be had upon request.

British Columbia

THE increase of 33⅓ per cent. on Canadian railroad freight rates, which went into effect August 26, has already commenced to bring additional business to Canadian shipping lines operating to the Atlantic seaboard from British Columbia ports via the Panama Canal route. When the rates were first announced it was predicted that ocean carriers would be given an added advantage over rail haul to the Atlantic coast, and this has been borne out by developments. The first copper movement by ocean will be made by the Granby Consolidated Mining Company on the Canadian Robert Dollar Company's vessel Grace Dollar, which is expected in Vancouver on her way from the Orient October 15th. The copper will be loaded at Vancouver and will be discharged at New York, the company believing that the water haul will not only cut down expense but ensure quicker delivery. The freight rate by vessel will be about half the rail charge, and it is estimated that it takes a car sixty days to get from Vancouver to the Nicholas Refinery at Loyal Hill, Long Island, while with steamer the freight can be delivered at the refinery in forty-five days. The company ships an average of 1,200 to 1,500 tons of blister copper monthly. It is probable that the lumber industry will take advantage of the Panama Canal route in making future shipments, if there is sufficient tonnage available. Lumber interests have strongly protested against the new rail rates and are reported to be now in the mood to back any project calculated to cut down the cost of shipments to the Atlantic seaboard.

The old cruiser Rainbow, formerly a part of the Canadian Government's naval organization on the Pacific Coast, has been sold to Neider and Marcus, of Seattle, and will be fitted out as an ore carrier to operate between British Columbia ports and the copper smelter at Tacoma, Wash. The Rainbow came from England to Esquimalt in 1910. She was built on the Tyne in 1891 and was rated as second-class steel protected cruiser of 5,600 tons. Her length is 300 feet, her breadth 44 feet, and she is equipped with engines developing 7,000 horsepower. She was built at a cost of $1,000,000, but that was nearly thirty years ago. During the war she did patrol work along the Pacific Coast and took the schooners Leonor and Oregon as prizes of war. These boats were returned to their owners after the war. The Algerine, another unit in the Pacific organization of the Canadian navy, was recently disposed of to the Pacific Salvage Company and she is now doing service as a salvor. A new cruiser and several destroyers will shortly arrive on this coast to take the places of these vessels.

Investigation shows that of the passenger movement to the Far East through British Columbia ports 85 per cent. of the passengers originate in the United States, 10 per cent. in Europe and only 5 per cent. in Canada. Figures show, however, that the Canadian Pacific Ocean Service, Ltd., with its fleet of big steamships, carried about 5,000 people during 1918, an increase of 800 per cent. since 1910. The liners of the Nippon Yusen Kaisha and the Oaaka Shoshen Kaisha carried 1,200. Now that the Pacific steamship Company has been assigned five 530-feet liners by the United States shipping Board the American company will be in a position to offer serious competition to both Canadian and Japanese companies. The Canadian government, however, is not without its aspirations to develop trans-Pacific service. Not satisfied with running two trans-continental railroad systems, it is now negotiating with the Cunard Steamship Company and the Holt interests to provide a regular service between B.C. ports and the Orient.

The Grand Trunk Pacific Steamship Prince Rupert struck a rock near Swanson Bay, on the west coast of the British Columbia mainland September 28, and it is probable that she will not be salvaged for several weeks. All the passengers were saved, but a big tear was made in the vessel's plates and water entered the holds rapidly. The Prince Rupert, with her sister ship, the Prince George, operates between Victoria, Vancouver, Seattle and northern British Columbia ports and is one of the largest in the coastwise business. It is estimated that it will cost fully $250,000 and probably more to place the Prince Rupert in commission again. The vessel is now lying on her beam ends and is completely submerged except at very low tide, when the stern is in sight.

The Northern Construction Company, of Vancouver, has been awarded the contract for building the Dominion Government (Ballantyne) pier in Vancouver harbor. The project will cost $4,500,000. The pier will be 1,250 feet long and 340 feet wide, with four concrete sheds, each approximately 500 feet long.

The Canadian Government is advertising for tenders for construction of the big drydock at Esquimalt, and work will probably be commenced before the end of the year. The work will probably cost more than $7,000,000.

The ocean docks at Ogden Point, Victoria, have been opened for regular traffic and the Blue Funnel liner Ixion was the first to dock there, loading a cargo of cement. The piers are being managed by the Canadian National Railways, which will probably establish a lumber assembly base there in the near future.

Captain H. C. Hansen has been elected managing director of the Victoria Shipowners, Ltd., which will operate the four wooden barquentines being built for the lumber carrying trade in Victoria by the Cholberg Shipyard. Captain Hansen, who has been associated with shipping activity ever since going to sea as a lad of fourteen, is the son of Southern Norway's leading ship operator, who bears the same initials. He came to Victoria shortly after the war and was one of the men responsible for the establishment of the Cholberg Shipyard. Before coming to the Pacific coast he was interested in a number of European shipping concerns, but he intends to drop these affiliations and concentrate upon operations out of British Columbia ports. He is a director of the Commodore Shipping Company, of Seattle. Framing of the third schooner to be built by the Cholberg company for the Victoria shipowners has been commenced.

The Dominion Government has decided to lay up the trawler Armentiers and patrol ship Stadacona, both of which vessels were brought around from Halifax shortly after the armistice was signed. The Thiepval, which was also brought around about the same time, is engaged in the fisheries protective service.

The Laurel Whalen, auxiliary wooden schooner built in Victoria in 1917 by the Cameron-Genoa Mills Shipbuilders, Ltd., has been sold to French interests, the transaction having been consummated within the past few days. The legal complications that followed upon the ill-fated voyage of the Laurel Whalen from Australia to Vancouver are now in the hands of the average adjuster. The schooner left Sydney with a cargo of grain and tallow and ran into a succession of storms that forced her to return for repairs and eventually to seek shelter at Papeete in the Samoan group, where she lay for a time before being towed to Vancouver by the tug Hercules.

The action which is pending before Judge Jeremiah Neterer in the United States district court at Seattle at the instance of the relatives of passengers and crew of the C.P.R. steamer Princess Sophia, which went down with all hands near Vanderbilt Reef, Lynn Canal, Alaska, October 25, 1918, will soon reach the trial stage. A commission will start collection of evidence in Victoria, Seattle and Vancouver in the near future. William Martin, of Seattle is acting as counsel for American claimants, and P. J. Sinott, of Victoria, for the Canadians.

The coasting steamer Trader, which has been operated in the Vancouver-Victoria service for many years, recently changed hands, the Gulf Steamship Company having sold the vessel to a Victoria syndicate known as the Trader Steamship Company. Charles D. Vincent, whose father formerly owned the Trader, is the manager of the new company.

The Commercial Cable Company, of New York, which owns the cable ship Restorer, stationed before the war at Esquimalt, has been urged to make Esquimalt against the base of operations on this coast. The company has replied to Victoria commerical organizations that the Restorer is now at Charleston, Wash., but whenever a change of location is considered Esquimalt will not be overlooked.

S. C. Ruck and W. M. Kelly, executives of the recently organized Vancouver Island Whaling Company, have left for the British Isles with the intention of having two or three whaling steamers built for service off the west coast of British Columbia.

OIL BURNING PASSENGER SHIP

Expert Committee and Prevention of Fire

Important recommendations are contained in the report of the committee appointed by the Board of Trade to advise on the conditions to be complied with to prevent danger of fire on passenger ships burning oil fuel. The evidence collected indicated the chief cause of fire to be leakage from flange joints in the pressure system conveying heated oil to the burners, and the committee are favorably disposed towards the use of froth as a fire extinguishing medium, and recommend the installation of suitable means for its application in the boiler rooms of vessels using oil fuel in addition to the usual fire extinguishing appliances. The committee's report continues: "We have seen in operation an indicating apparatus suitable for ascertaining the oil level in oil storage tanks, and thus dispensing with the use of sounding pipes, the open ends of which are objectionable when situated in passenger or other closed-in spaces. In the interim report of the expert committee on fuel oil specification to the Right Hon. Walter Long, M.P., a copy of which was transmitted to the Board of Trade on the 18th November, 1919, emphasis is given to the importance, in view of the proposed adoption of oil fuel having a flash point as low as 150 deg. F., of accurately determining the flash point of the oils to be used, and it is recommended that when a more accurate apparatus is devised the Board of Trade should insist on its adoption. In this connection we have witnessed a complete demonstration of the various methods and types of apparatus used for determining the flash point of oil fuel, and append to this report notes prepared by Professor Brame, F.I.C., F.C.S., who gave the demonstration, whereby we realized to the fullest extent the difficulties referred to in the above mentioned report. Pending the invention or production of such improved apparatus, Professor Brame appears to us to have arrived at a practical solution of the difficulty by his recommendation that, in place of requiring the chief engineer to ascertain the precise flash point of oil fuel, he need only be required to satisfy himself that the oil fuel does not flash below 150 deg. F. Professor Brame demonstrated that this can be carried out most reliably and satisfactorily with an existing type of apparatus approved by the Standards Department of the Board of Trade under the Petroleum Acts. The proposed instructions are embodied in our recommendations and a copy of Professor Brame's 'Notes on the Flash Points and Ignition Temperatures of Heavy Oils,' is attached.

Position of Bunkers

"The question of oil fuel bunkers at or extending to the ship's side, and the possible danger therefrom of fire, in the event of the inner plates being pierced or badly shaken by collision, has been carefully considered. In passenger ships of high power, or in ships making long voyages, the difficulties of avoiding bunkers adjacent to the ship's side in way of the boilers are almost insuperable. The alternative of using the double bottom under boiler rooms for storage of oil fuel is also open to question in view of the possibility of the inner plating being pierced in the event of the ship stranding on rocks, thus permitting the oil to flood the compartment above. Danger of fire from such arrangements exists in the event of the inner plating being pierced or so badly shaken as to cause the seams to leak heavily, in which case the compartment would be flooded with water and oil. In either case the oil carried along by the water might, but in our opinion would not necessarily, take fire. On the other hand, if the outer plating only were damaged, the inner plating of side bunkers might prevent serious flooding of the ship and thus be a safeguard. Precautions which appear to us to be necessary and sufficient have been embodied in our recommendations."

Precautions Recommended

In an appendix to the report the conditions and precautions for passenger ships burning oil fuel are proposed. In the course thereof it is stated that in any space where oil vapour may accumulate, no artificial light capable of igniting inflammable vapour shall be allowed. Such spaces are to be illuminated by means of an electrical installation, preferably not on the single wire system when the electrical pressure exceeds 110 volts, and no switches or fuses may be placed in any such space. The electric lamps are to be protected by airtight well glasses and by wire guards, if the latter are considered necessary. Portable lamps supplied with current through flexible cables shall not be permitted. Self-contained battery-fed lamps similar to those used in fiery mines must be provided for use in such spaces.

With regard to precautions against fire, there should be, in addition to the usual water service and hose-pipe conductors, one of which might be provided with a nozzle having perforations in it to spray the discharge, steam from the auxiliary range of piping to be led to pipes perforated for the emission of steam into the lower parts of the boiler room. The control of this steam supply shall be outside the boiler room. There shall be in each stokehold a receptacle holding about ten cubic feet of sand, sawdust impregnated with bicarbonate of soda or other approved dry material suitable for extinguishing fire. Suitable scoops for distributing the same are to be provided, also a chemical fluid extinguisher of an approved type for use in any specially confined or dangerous space. As a further precaution it is strongly recommended that there should be also provided a suitable installation capable of discharging froth in large quantities into each boiler room, and so arranged that it may be put into action from outside the space affected.

BOOK REVIEW

The well known British firm of Armstrong Whitworth have just issued a booklet, describing the activities and resources of their famous yards at Elswick and Walker-on-Tyne. The book traces the development of the firm from 1848, when the Walker yard belonged to C. Mitchell & Co., and constructed warships to Armstrong designs, to the present date. It is interesting to note that the British Admiralty have secured no less than three Directors of Naval Construction from this firm, these being Sir William White, Sir Philip Watts and Sir Eustace Tennyson D'Eyncourt. The book is very handsomely illustrated, and views are given of all parts of the various shops, besides a number of photographs of the different types of vessels built by the firm. These include practically all classes of merchant ships, and war vessels, besides ice breakers and train ferries. The famous train ferry from Richborough to France which did such wonderful work during the war was built by the firm of Sir W. G. Armstrong, Whitworth & Co., and this ferry carried over many 14-inch guns also built by this noted organization.

The keel of the first 12,000-ton tanker, the largest steel ship ever built in the Pacific northwest, has just been laid at Vancouver. This tanker will be built for the Standard Oil Company, and the company will build three of the same size.

The Electric Propulsion of Ships

A Paper Read Before the Institute of Marine Engineers, London, in Which the Author Traces the Development of Electric Propulsion from Its Inception to the Present Day.

By CAPT. W. P. DURTNALL, R.A.F.

(Continued from last issue)

IN THE case of partial stripping of the turbines (a not uncommon thing with "Reversing" turbines), it is obvious that to keep a high speed steam turbine running out of balance, or with say bearing trouble, is impossible, and the speed reduction gears with their numerous operating teeth would present almost equal difficulty. In the event of a smash up a ship would have to be stopped until the wreck could be cleared, and the work necessary to uncouple and disconnect any part of such machinery and heavy apparatus would be a very serious matter, involving much valuable time, including that required to stop the ship, and after the disconnection was made the idle propeller would act as a drag on very fast vessels.

In all steam turbine driven ships (mechanically geared, or otherwise) it is thus essential to provide and instal "Reversing" turbines, these extra turbines being connected to the same shaft, must consequently revolve round at high speed in their reverse direction when the ship is being propelled "Ahead" and the ahead turbines are at work, they involve considerable control complications which are objectionable, and even if these are reduced to a desirable minimum the actual "Reversing" power is greatly inferior compared with the "Ahead" power, consequently no turbine-driven vessel is fitted with a "Full Power" reverse, and it is surprising to me that ships so incomplete in regard to safe handling are allowed, especially for passenger carrying work at high speed. I have heard it stated that a certain battleship carried on for about 2 miles before being brought up from full speed by the weak reversing turbines, but in the case of the trials of the *Lusitania* she entered the measured mile at 22.8 knots with the revolutions of the propellers running ahead at 166 r.p.m., the engine room telegraphs were rung down for "Full Speed Astern" and it took three minutes 55 seconds to pull her up, and over a distance of about three-quarters of a mile; what she would have carried on over had she entered the mile at her full speed of 26 knots, instead of the 22.8 knots as tested, can well be imagined; it, however, indicated a feature of high interest in future marine engineering.

Elaborate experiments which have been made show that a steam turbine forced to turn in an opposite direction to which it goes when supplied with steam involves about seven times as much friction loss as when it is driven in its normal proper direction. This loss is very appreciable in the reversing turbines of ships and causes considerable "heating," which has to be dissipated by circulating steam, which causes further loss and waste.

There are also serious difficulties and dangers in high-speed turbine prime-movers incidental to the abrupt and wide changes of temperature, as say, when steam is suddenly admitted to a relatively speaking "cold" reversing turbine, this being the prime cause of many accidents by stripping the blades, etc. There are other serious effects possible in connection with very large steam turbine driven ships as the following will show.

Steam which expands without doing work has a high temperature, and if steam is turned on a reversing turbine which is being driven in the "Ahead" direction (or its reverse direction) the local heat is very considerably increased, and if superheated steam is used (as it ought to be used on all ships) these local temperatures may be extreme, as they affect the "Ahead" turbines, as well as the "Reverse" turbines, since the two turbines are often mounted in the same casing and on the same shaft. The mechanical effect of such abrupt change of temperature upon fragile structures such as turbine blades, representing as they do very extended exposed surfaces, is a matter which has been up to now very little considered, but, which has in the past on turbine driven vessels given much serious trouble at sea.

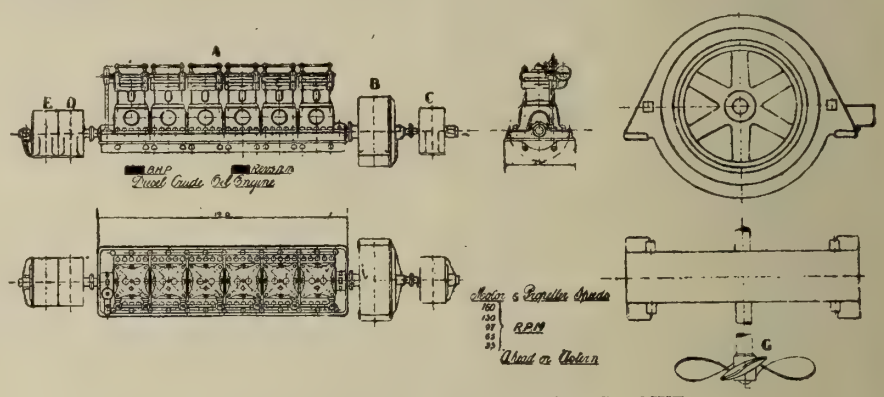
Various statements have been made in the past few years concerning the efficiency and losses in high-speed mechanical reduction gearing by various people, much in advance of the accurate tests which have been made in a well-known large works in America. The losses shown by the most accurate tests carried out by the motor-generator method, which is generally acknowledged to be the most complete for large powers, and by which the actual transmission losses can be most correctly measured, these tests have shown that the losses are greater than those claimed by various manufacturers of high power reduction gearing, and to check these measurements, the same power was transmitted, "with" and "without" the gearing.

A further disadvantage of the set ratio mechanical reduction gear method of turbine propulsion is the fact that unless a separate set of "Cruising" machinery is installed, that for "Cruising" speeds it is essential to slow the turbines, and this causes a rise in the steam and fuel consumption, and a fall in the thermal efficiency, and in the case of a warship this is serious, as about 90 per cent. or more of the life of the ship is spent when travelling at the "Cruising" speed, considerably affecting the fuel bunker capacity per 1,000 ton miles of displacement at those speeds.

Enough has been said to indicate that steam turbine driving for ships has really failed to improve matters commercially, and although when operated under its ideal conditions as regards high revolution speeds, and with high temperature steam, and always running in one direction, it is a useful and efficient high power "Steam" prime-mover, the operating conditions which are demanded at sea for propeller driving are not at all suitable for its proper application, and its use has so far been only a wasteful compromise.

It was this knowledge which led the author to investigate the possibilities of the "Electrification of Ships" in 1903, experimenting with the continuous current system, which, although indicating an improvement in the thermo-dynamic propulsive efficiency, still offered many disadvantages, although eminent firms of high repute were in a position to quote for the electrical machinery, the matter did not proceed until 1905, when successful experiments resulted in the author bringing out what is now so well known as the "Paragon" Thermo-Electric Ship Propulsion System.

This system embodies the use of poly-phase alternating current power transmission and by its use the turbine or internal-combustion prime-mover could run at high revolution speed, always in one direction, independent of the direction in which the vessel was proceeding, it provided the ideal control from both bridge and engine-room, it facilitated the use of slow revolution large area efficient screw or other propellers, producing high thrust for the shaft horse-



COMPARISON OF DIESEL ELECTRIC DRIVE

power; it brought into use the high speed non-reversing steam turbine, with all its simplicity and reliability, its low cost and maintenance, its light weight, its high thermal efficiency, and safe means of using the highest super-heated steam, without danger or complications, it provided means by which the prime-mover could be made entirely (mechanically) independent of the propeller shafts, thus facilitating the installation of the power producing plant in any satisfactory part of the ship and in close proximity to the boilers, it thus reduced the pressure and the radiation losses and the size, weight, and cost of main, exhaust, and condenser piping, it provided a "Full Power" reverse for the propellers, making a safer ship, much more rapid handling, with the least trouble to the engineering staff, and owing to the smaller amount of steam required per effective horse-power hour it materially affected the number and size of boilers required for given speed and displacement.

It was indeed because of the previously mentioned facts that I named the new system the "Paragon" System; it was the best, cheapest and most reliable system of ship propulsion that I had so far struck, and has since been so well tried at sea and has maintained its original name. In 1906 I applied for patents in 25 countries, and in 19 countries my patents were granted, at a cost of over 800 *l.*, several applications being still in abeyance.

The system covered the use of exciter control for facilitating the change of connections which has been so successful in many ships of recent years, this brought about means by which the very largest powers could be controlled, with great rapidity and certainty, besides avoiding the usual difficulties of synchronising and other features in ordinary polyphase current plant operation, a very fine method being employed in the latest method for high powered liners and battle cruisers now being proposed.

The use of this system brought about means by which the heavy main current was generated in stationary parts, and not revolving parts, as in my continuous current system, patents for which were granted in 1905. The only revolving members in the system were the motor rotors and the generator exciting fields, and these were at very low voltage, and safe for attention and handling, and its use brought about means by which a whole multitude of schemes could be designed out for all classes of vessels, either with steam or internal-combustion prime-movers, and although in some cases the slip-ring type of motor has been used, the system provides the means by which the strong, efficient, light, low cost squirrel cage induction electric motor can be directly coupled to the propeller shafts, and thus forming the most simple and efficient driving force for main marine propulsion, in fact in the latest method of applying the "Paragon" System for large vessels there is no switch-gear at all with the exception of one for "Reversing," and this is only in use under no-voltage conditions, the whole speed control being carried out on the low voltage side of the system, representing a tremendous advance over my early schemes and what has been previously carried out at sea.

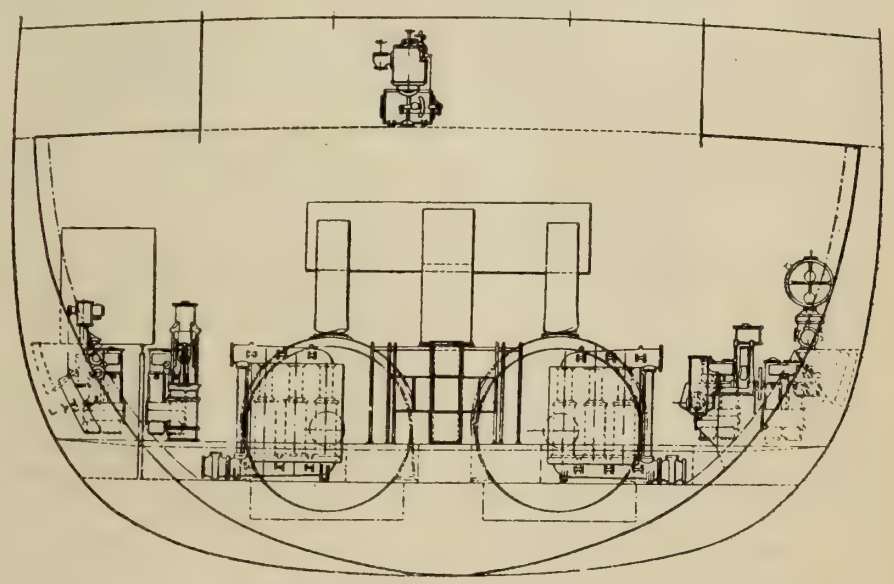
There is no doubt about it, the squirrel cage induction electric motor is the most efficient motor or driving machine in existence, and like the high speed steam turbine it has only one moving part. Its very simple construction, combined with its great mechanical strength has proved its high favor in the heaviest powered ships afloat. it has no slip-rings or brush-gear, to give possible trouble, the whole working current in the revolving portion being induced across one air gap, in which there is nothing touching, and consequently no wear can take place affecting the life and maintenance efficiency, which is a tremendous advantage especially when dealing with large powers. This motor has no sparking limit, as is the case in all conduction machines, consequently the output per unit weight is much higher than in any other type of electrical machine. and with gain in efficiency. A large section can be given to the windings of these machines, which combined with the fact that the windings are arranged so that copper losses are not localized, and that the iron is of a laminated character in construction of both the stator and the rotor, provides every means for effective ventilation. Burnt-out armatures and the turning of commutators are the bugbears of all engineers operating electrical machinery, but these effects are practically unknown in the case of the squirrel cage induction motor, and now means are provided by which it may be satisfactorily started against load, it offers the ideal method of driving propeller shafts for all kinds of sea-going vessels, and I have had these motors running many months on end without stopping and under full load all the time, without skilled and with very little unskilled attention, without the least trouble.

The system was made public for the first time on July 18th, 1908, before this Institution, at the Congress Meeting held at the Franco-British Exhibition, London, in connection with a Paper I had the pleasure of reading on its application to Cross-Channel Ships, and the Institute honored me by the award of the Denny Gold Medal.

Some years ago, Mr. Tachikawa, the well-known Japanese electrical power engineer, after having studied my system at my London office, went back and read a paper on Marine Electrical Propulsion before the Engineering Society at Tokio, Japan, and made extensive references to my work, and printed in English a full description of my original claims to be able to drive a battleship with a fuel saving of no less than 27 per cent., this as far back as April 12th, 1909.

Mr. Henry Mavor, in Glasgow, fitted a small vessel with the system, using a suction gas plant and polyphase alternating current transmission to the propeller; the boat was 50 feet long, 12 feet beam, and 4 ft. 6 in. draught, the engine ran at 800 r.p.m., and the propeller speed just under 400 r.p.m., she did 8½ miles per hour over the measured mile, and could be brought to a standstill in 23 seconds, and it took 13 seconds to reverse from the full speed "Ahead" to two-third speed "Astern." Tests carried out on May 31st, 1911.

A further development by the late Mr. Mavor was made in connection with a Canadian barge, the *Tynemount*, the plant for this vessel consisting of two six-cylinder Diesel cycle engines. driving two polyphase alternators at 400 r.p.m., the combined energy being concentrated in a special squirrel cage induction motor which drove the propeller shaft at 78 r.p.m. at full speed. Tests made on this vessel showed that the propeller was reversed from full speed "Ahead" to full speed "Astern" in 15 seconds, which is an excellent demonstration of the capabilities of the squirrel cage induction motor to the work of starting and acceleration torque required for marine propeller driving.



VIEW OF MIDSHIP SECTION

For some reason this interesting vessel was afterwards equipped with reciprocating steam engines, it has not been made public as to why this was done, as there is no question that the engines were of first-class make, the alternators were of modern and reliable design, the only question which I raise was in the type of motor used, it was of a type with two windings in the stator, similar to that which I used in connection with my original petrol-electric motor omnibus a few years previously, in which I

ound that the two windings being placed n the one set of slots made the slots extra long and thus increased the magnetic circuit and lowered the motor efficiency, otherwise the plant was well designed and made, and I have no doubt the present high cost of fuel has caused the owners to wish that the origial plant had been retained. It was a pity that Mr. Mavor did not adopt the well tried and reliable squirrel cage single-winding motor which I have always advocated from the first introduction of the system in 1908.

In May, 1909, I contributed a Paper before a large company of naval engineers at Chatham, the chairman for the evening being Mr. F. Purser Fletcher, A.M.I.E.E., the then First Assistant Electrical Engineer of the Chatham Dockyard; in this paper I referred to the possibilities of the utilisation of the "Paragon" System for the propulsion of battleships, and compared the steam consumption of well-known ships, and showed to the satisfaction of a technical meeting of sea-going naval engineers that a saving in fuel could be made in battleships of no less than 27 per cent.; as an estimate this was not far short of the facts which have since been proved at sea in the latest and heaviest battleships in the world in the United States Navy, but it was thought to be too good to be true in those days, and direct-coupled turbines were continued and installed.

On November 18th, 1909, Mr. W. L. R. Emmet, the chief engineer of the turbine department of the General Electric Company of Schenectady, U.S.A., presented America with its first enlightenment as to the great possibilities of the system, when he read a well though out paper before the Society of Naval Architects and Marine Engineers in New York, on Applications of Electricity to the Propulsion of Ships. Mr. Emmet confirmed all the claims which I had originally pointed out in my previous papers, and, being such a well-known authority on the turbine, having designed and manufactured the direct-coupled turbines for a number of battleships, his words weighed greatly with the naval engineers in that enlightened and go-ahead country, in which most brilliant work has, and is being done with this English invention. Mr. Emmet has done more than anyone else in America to advocate and use this great advance in marine electrical engineering, and immense credit is due to him for such a display of intelligence and faith in his profession. Although especially interested in, and appreciative of this work, I do not agree with the well meant statement of Mr. J. Daniels, the excellent and progressive Secretary of the United States Navy, who, when reporting to Congress in December, 1918, referred to the most successful trials of the new electrically propelled battleship *New Mexico*, and gave details of her indeed wonderful performance, both from the engineering and military aspects, carried out by some of the cleverest engineers and officers of the U.S.A. Navy, expressed his high appreciation of their work, in face of the opposition.

"The *New Mexico*, report proceeds to state, has failed in none of the exhaustive trials recently carried out: the operation of her machinery has been highly satisfactory in every respect, and to-day in this unique vessel the United States Navy has a battleship which has no peer in the World's Navies,

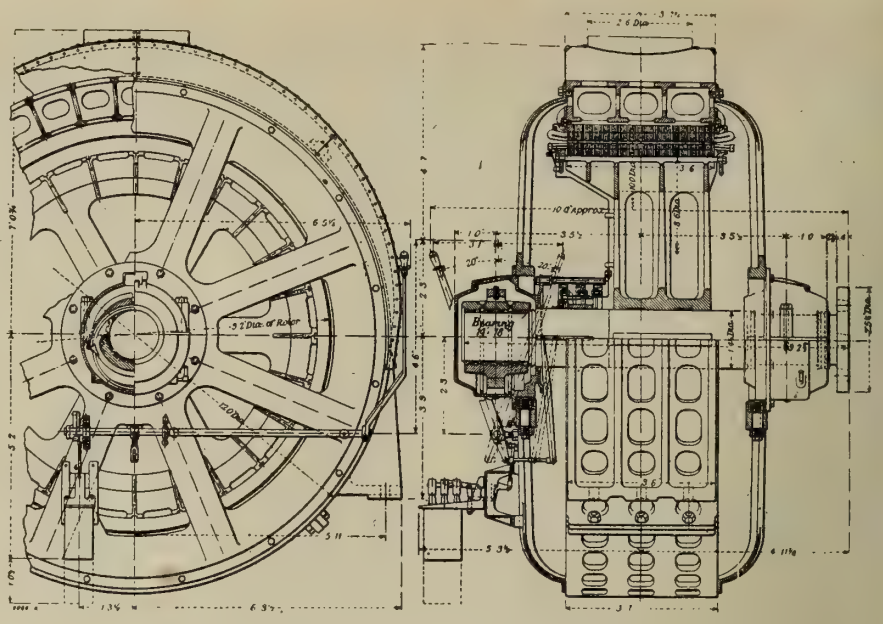


DIAGRAM OF MOTOR

not only for economical propulsion and less liability to serious derangement, but for her military superiority in greater manoeuvring power and increased under-water protection."

With splendid appreciation of great foresight and thoughtful consideration of a great departure from the orthodox methods of old fashioned "Steam Propulsion" he goes on to state:

"In this successful revolution in the propulsion of the biggest fighting ships, as too often before," he adds, "American ingenuity and inventive skill now lead the world in the propelling machinery of battleships."

Mr. Daniels, of course, was not aware of the origin or the development of the system in this country, and that the ingenuity and inventive skill originated in England, and was publicly described, and ably discussed by the members and friends of this Institution as far back as 1908.

We must, however, give the highest possible credit to the United States naval officers and Mr. Emmet for the fact that, although they did not introduce the system, they were the first to build the big power experimental plant, the trials at sea, and the magnificent appreciation of the merits of what can be well claimed as the most advanced development in marine engineering during the last century, in my opinion they have advanced this great art, by at least 25 years, the tremendous economies proved, the advance in the military aspect of such ships will compel others to follow, where they might well have led.

On March 17th, 1910, I read a Paper before the Institution of Naval Architects in London, the chair being taken by Sir William White, the title of the Paper was "The Substitution of the Electric Motor for Marine Propulsion." The discussion was opened by the Hon. Charles Parsons, who stated that in his views there was very great dangers of short circuits by the adoption of the system for ships.

I took the matter up with Dr. Kapp, of the Birmingham University, who was kind enough to investigate the matter, writing me to the effect that he could hardly coincide. It however had the effect that a contract which I had entered into on the 28th of October, 1909, with Mr. Arthur John Maginnis, Consulting Engineer of Liverpool, was very shortly afterwards cancelled, and what would have been the first ship in the world propelled on the "Paragon" System was stopped. The ship to be converted was the *S.S. Ivy*, a vessel of 1,241 tons, with a speed of about nine knots, and with about 500 I.H.P. The vessel, however, at a later date was lost at sea, but had the contract been carried out she would have been the first large vessel in the world propelled on my polyphase alternating current system.

The features which appealed to marine engineers and which must be complied with by any type of propelling machinery can be drawn up as follows:

(1) The driving power must be simply and quickly reversible.

(2) It must be capable of being started and stopped quickly.

(3) It must be capable of being promptly speeded up and down from dead slow to full speed, or even in case of emergency be capable of giving out power sufficient to produce vessel's speed above the normal for short periods of time.

(4) It must be capable of being kept running at any desired set speed, and of running at that speed economically for very long periods. The "dead slow" should, if possible, be slower than one-fourth of the normal "full speed" revolutions, and on very fast vessels one-eighth or less.

(5) It must be capable of working well and reliably in smooth or rough water, and with the power varying from zero to sometimes more than the normal maximum for short periods, when the propeller changes in resistance to rotation.

(6) It must meet the previous conditions without racing or showing more than, say, five to eight per cent. deviation from the normal set speed, and in case of heavy rolling means should be provided to vary the power automatically from "port" to "starboard" propellers when operating two or more propellers.

(7) All working parts must be readily accessible for overhauling and adjustment,

and all wearing surfaces must be capable of being easily examined.

(8) The driving machinery must be economical in fuel at all speeds, especially at the normal full speed at which it is generally run, and the machinery should have the least number of working parts.

Fractures in the tunnel and tail shafts sometimes occur in spite of the most careful inspection, and such an accident is very serious, especially on single screw vessels, and may even lead to the loss of the ship and crew. A ship is practically a flexible girder, the longer the propeller shafts are the greater the strains set up in them, and this source of danger should be minimised by making the shafts as short as possible. This is done in certain vessels, such as cargo boats, in which it is preferred to have the machinery at the stern, to give by its weight sufficient propeller immersion when travelling light, but in passenger boats the boilers and machinery are generally placed forward, so that long tunnel shafts are unavoidable. Vessels driven on the "Paragon" system have the undoubted advantage that the steam or other power generating plant may be placed right forward, whilst the propeller driving electric motors may be placed as far aft as the lines of the vessel will allow.

In connection with the subject of the conversion of existing ships to "Paragon" propulsion, I, some years ago, had great difficulty in getting the diameter of the induction motor down to the proper centres on some small cargo boats which I was asked to design plans for. I found that in order to get good low steam consumption per kilo-watt generated, I was compelled to raise the revolution speed to 4,000 R.P.M., this with a two-pole generator produced a periodicity of 66.6 per second or 8,000 alternations per minute, the propeller speed was to be 80 r.p.m. (not counting slip), so this meant a motor with no less than 100 magnetic poles. Drawing this motor out, I found that the large diameter did not allow of installation in the vessel, and I was on the point of adopting mechanical gearing between the electric motor and the propeller shaft, when I found out a means by which I could generate only 4,000 alternations per minute at 4,000 r.p.m. in quite a novel manner; we can now provide at least double the reduction ratio than we could have done previously, and the reduction in the steam consumption or the heat units used by my higher speed turbines has solved the problem for the equipment of small cargo vessels, and one of the important departments of the "Paragon" Company will be the conversion of existing ships, and I may add that a considerable number of enquiries are now in hand for this work, as there are many vessels to-day with good servicable hulls and boilers which may be brought up to date with the installations of the more modern propelling machinery, and the change brought about in very short time.

This conversion business is full of interest; ships which have fairly good steam plant in the way of boilers may be converted and still use the steam cycle with the high speed light-weight turbine as prime mover. A few years hence, by simply taking out the boilers and turbine generators, these can be replaced by a "Paragon" internal combustion generating plant, these boats may be thus changed into internal combustion vessels with the minimum of cost, and the high thermal propulsive efficient of the new heat cycle embodied in the change—a point which should be appreciated and given thought to by progressive shipowners and engineers.

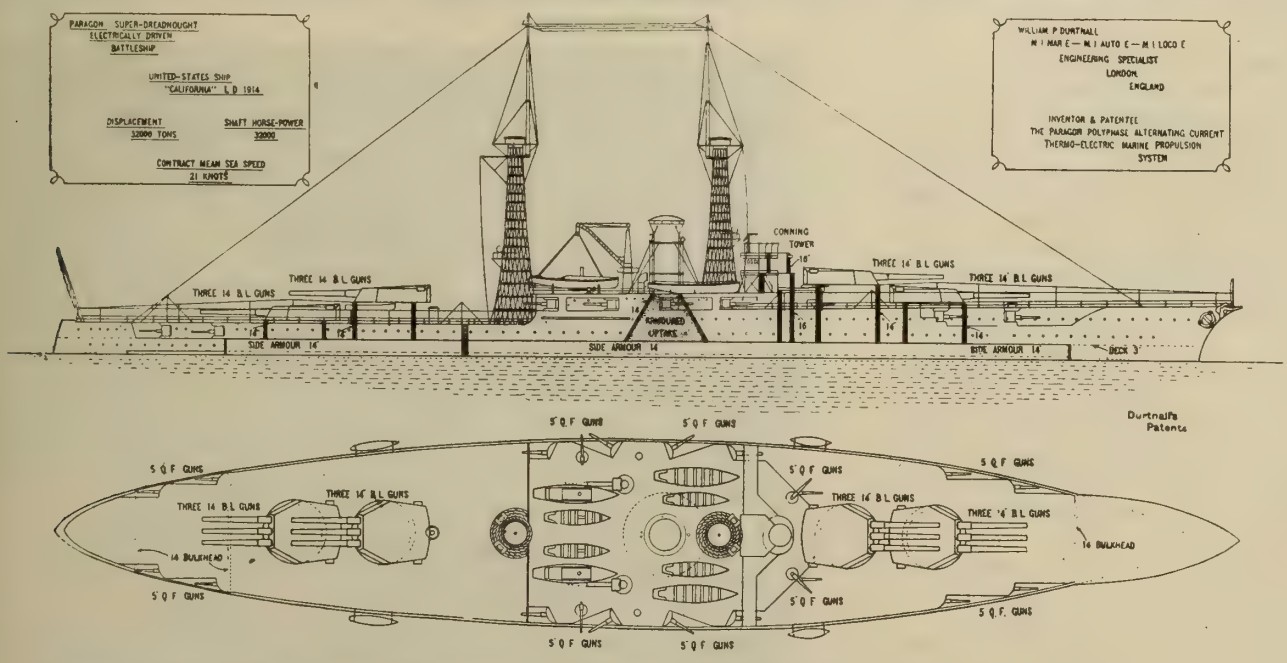
Whilst on the subject of internal-combustion engines such as will be embodied in many of our new and converted vessels, I would draw attention to the excellent engine which has been the result of a number of years' development by Commander Geoffrey T. Bowles, R.N., and myself. Com. Bowles in 1912 was a very progressive shipowner, and resulting from a lecture which he heard me give in this building in 1910 before this Institution, we became acquainted. He thoroughly appreciated all it meant to the shipowner if we could by some method make the internal-combustion engine more reliable and consequently more suitable for long-voyage vessels, such as on those his business was concerned in. In 1912 we brought out jointly what is now well-known as the "Paragon" silent cycle for internal-combustion engines, and which we thoroughly believe will be highly appreciated by sea-going engineers as well as ship owners who wish to reduce the operating costs of their vessels and provide reliable machinery for their ships.

(To be Continued)

ANOTHER FIRM TO BUILD DIESELS

The Worthington Pump and Machinery Corporation have issued a bulletin announcing their entry into the marine Diesel engine construction field. The bulletin reviews the marine situation and the case for the Diesel internal combustion engine, and quotes instances of actual working to demonstrate the reliability of this prime mover. The announcement of the building of a 2,400 I.H.P. six cylinder marine Diesel by the company follows. This engine was built at the company's Snow Works, Buffalo, and the cylinders are 29 inches bore by 46 inches stroke, and the crank shaft makes 120 revolutions per minute, the engine being of the 4 cycle type. The engine is built to the Worthington Company's own designs, but the leading features of successful foreign builders have been incorporated. The company have made plans to enable them to produce these engines in large numbers as the demand increases.

The Engineering Sales and Service Co., 55 St. Francis Xavier Street, Montreal, have obtained the Canadian agency for Haughton's Patent Metallic Packing Company of London, Eng., manufacturers of high grade anti-friction packings.


PARAGON SUPER-DREADNOUGHT ELECTRICALLY DRIVEN BATTLESHIP
UNITED-STATES SHIP "CALIFORNIA" L.D 1914
DISPLACEMENT 32000 TONS
SHAFT HORSE-POWER 32000
CONTRACT MEAM SEA SPEED 21 KNOTS
WILLIAM P DURTNALL
M I MAR E — M I AUTO E — M I LOCO E
ENGINEERING SPECIALIST
LONDON
ENGLAND
INVENTOR & PATENTEE
THE PARAGON POLYPHASE ALTERNATING CURRENT
THERMO-ELECTRIC MARINE PROPULSION
SYSTEM
THREE 14 B.L GUNS
CONNING TOWER
ARMOURED UPTAKES
SIDE ARMOUR 14
DECK 3
5 Q F GUNS
TWELVE 14 B.L GUNS
14 BULKHEAD
Durtnalls Patents
LENGTH OVER ALL 625 FEET
BEAM 97 FEET 3 INCHES
DRAUGHT 29 FEET
MAIN ARMAMENT TWELVE 14" B.L. GUNS
SECONDARY ARMAMENT TWENTY TWO 5" Q.F. GUNS
SUBMERGED TORPEDO TUBES FOUR 21 INCH TORPEDOES
BELT ARMOUR 14 INCH
GUN SHIELDS 10—9 INCH
14 INCH ARMOURED FUNNEL BASE
14 INCH ARMOURED CONNING TOWER
BELT ARMOUR DEPTH 17 FEET 6 INCHES
BELT ARMOUR ABOVE WATER 9 FEET
50 PER CENT REDUCTION IN BOILER ROOM SPACE
EXTRA ARMOUR PROVIDED AGAINST SUBMARINE EXPLOSION
JAPANESE TYPE BOW GIVING IMPROVED SEA WORTHINESS
GREAT FUEL ECONOMY & EXTENDED TRAVELLING RADIUS
ELECTRICAL CONTROL WITH IDEAL MANOEUVRING POWER
MAXIMUM THERMAL & FIGHTING EFFICIENCY

PROGRESS IN NEW EQUIPMENT

There is Here Provided in Compact Form a Monthly Compendium of Shipbuilding and Marine Engineering Auxiliary Product Achievement

NEW OPEN-SIDE PLANER

The L. & P. Manufacturing Co., Niagara Falls, Ont., have placed on the market both open-side planers and the double column planer shown in illustration. The beds of these machines are of closely ribbed type fully enclosed between the ways. The fourteen-foot machines have three oil wells provided to each of the vees. The worm bearings are cast solid in the bed with reservoirs to maintain oil above the centre of the drive. Outside housing for thrust bearing and reduction gears are cast solid with the bed.

The housings of the double column planer as shown in illustration are of heavy box pattern, provided with clamping screws for holding in working position to both housings.

The planers are of double deck box type, having ports in sides for removal of chips, stake holes being drilled through top deck only. This prevents chips dropping into driving mechanism. Three tee slots are provided and four rows of 1-inch stake holes spaced twelve inches apart each way.

The columns are of heavy box pattern and are well ribbed and securely fastened to the bed.

Four tool heads are furnished on the two column planer, two on the open-side planer. Each of these heads are of standard heavy swivel type provided with parallel gibs with set screw take-ups. The feed screws are fitted with micrometer collars.

The parallel drive is obtained by forged steel worm and cast iron machine cut rack, the worm lying at such an angle that thrust is parallel to the ways.

All shaft bearings are split bronze lined boxes, excepting those supporting the worm, the latter being solid. The drive thrust bearings are readily adjustable, and consist of a number of steel, bronze and fibre disks, having radial oil grooves across their faces. They run in an oil well located outside the bed. Reversing thrust bearings are similar but are located inside the worm oil well.

Worm bearings and oil reservoir are piped to filler connection outside of bed, and thus platen need not be removed for refilling. The balance of drive bearings, being outside of bed, are accessible at all times.

The motor is connected by flexible coupling to driving pinion shaft on left hand side behind planer close to bed.

The reduction gears consist of one pair of wide face spur gears fully enclosed, arranged to run in oil, the drive pinion being provided with an outboard bearing.

Following are the specifications for the double column machine. Planer width 48 inches, width between housings 50 inches, length of table over all 15 feet 6 inches, length of bed over all 23 feet 4 inches. The length of down feed of head or cross rail is 9 inches, and the minimum distance centre of tool blocks is 19 inches. The width over gear belt is 8 feet 1½ inches, and the height over gears 8 feet 10 inches.

The other specifications herewith on the open-side type are self-explanatory, and these machines are made in both the belt and motor types.

Planer width 48 inches, length of table over all 15 feet 6 inches, length of bed over all 23 feet 4 inches, length of down feed of head on cross rail 9 inches, floor space length, including table travel 32 feet, planer height 48 inches, maximum height under rail 50 inches, width of table 44 inches, horse-power required 15 to 25. The drive motor used is a 25 horse-power reversible variable speed planer motor and runs from 250 to 100 r.p.m. The cross rail motor is a 2 horse-power constant speed motor running at 1,150 r.p.m.

AIR PLANER

The Turbine Air Tool Co., 710 Huron Road, Cleveland, Ohio, have placed on the market a line of air planers which are adapted for such uses as shaving telegraph poles, telephone poles, etc., etc. They are also used for railroad tie making, pile peeling, removing bark from logs for foundation building, and general dock, wharf, and dam building. There are of course many other uses for such a type of tool but let us go into a description of the same.

As can be noted light weight has

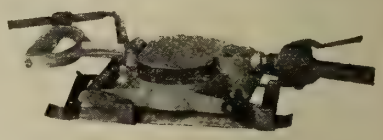


FIG. 1—SHOWING MODEL P PLANER.

been considered. The device has only thirteen primary parts, and has no reciprocal parts. The only wearing portions are the ball bearings and the only parts requiring replacement are the

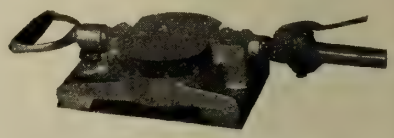
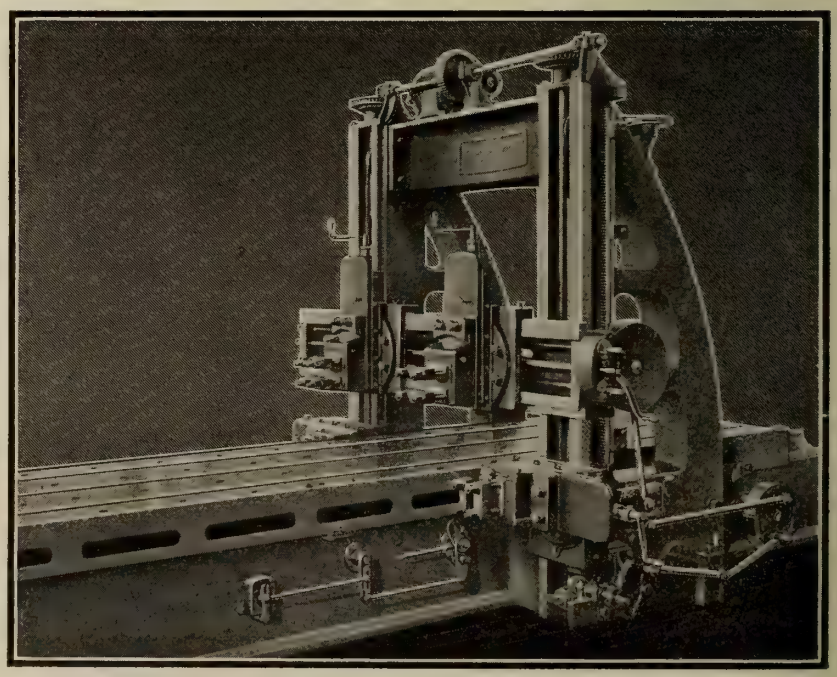


FIG. 2—ILLUSTRATING MODEL D.

knives and ball bearings. The work of making these replacements is exceedingly simple.

The power used is compressed air, and the speed is from nothing to 12,000 r.p.m. at the knife. The model P shown at Fig. 1 should be operated from an air compressor with 100 pounds pressure, giving 45 cubic feet of free air per minute.

The cost of maintenance is said to be



GENERAL VIEW OF THE DOUBLE COLUMN MOTOR DRIVEN PLANER.

neglible and the machine is easily kept in working order. The model D shown at Fig. 2 is similar to Fig. 1, with the exception that it is designed primarily for work on flat surfaces.

NEW CLEANING COMPOUND

A new preparation, known as "Meno" Rust Remover and Cleanser, has recently made its appearance on the market, and it is one that bids fair to be a boon of considerable importance to all concerns and individuals engaged in or allied to any metal products industry, inasmuch as it appears to be one of the most important labor-saving inventions of the age. The inventor who, realizing that the methods employed to remove rust, corrosion, etc., from machines, engines, tools, parts and all metal surfaces, required considerable time and involved high labor costs, set before himself the task of devising a much better and more economical cleansing method, and devoted many years to unceasing research and experimentation with the result that "Meno" Rust Remover and Cleanser was invented.

The name "Meno" is a word derived from the Latin and means "less work." It is a scientific combination and blending of certain chemical ingredients, which in combination produces an electro-chemical action that rapidly loosens and dissolves rust, corrosion, grease, oil, dirt, carbon, paint or any other foreign substance that is adhering to the metal —irrespective of its age or hardness— and its action automatically ceases when contact between the cleanser and the metal is established, and this is as far as it will go, for it will positively not injure or mar the surface of the metal itself in any way.

There are two methods of using the preparation, as follows:

1. Apply it to the machine or part with a brush and allow it to remain for a short time, then brush or rub it off and it leaves the metal bright and clean.

2. Mix the preparation in a vat, tank or container with water, then attach the machine or parts to wire or chain so that they will hang in the solution. No further attention is required since the process of cleaning goes on while the parts are immersed.

It is stated that the preparation is absolutely safe in every way and that it will not burn or explode.

Another important point in its favor is that it will not cause corrosion or rust to form, for, in fact, it protects the metal and makes it exempt from corrosive or disintegrating action for a long period after it has been treated by this preparation, and there need be no fear of injury to the most delicate part, no matter what metal it is composed of.

The preparation is an economical one to use as the same solution may be used many times over as it does not deteriorate or lose its cleansing power.

Peter A. Frasse & Co., of 417 Canal Street, New York, are the sole distributors, and are now establishing agencies in various parts of the country for the sale of this preparation.

A REMARKABLE RESULT

The "test to destruction" is occasionally resorted to by makers of machines to discover how far their products will go beyond the usual limits of effort without breaking down. One British firm of machine tool makers adopts the test to destruction as a regular practice in the case of new models. On a recent occasion a large drilling machine was thus being tested. A twist drill of special high-speed steel, one and a quarter inches in diameter, was set to work at five hundred revolutions per minute on a piece of solid cast iron. General knowledge of the traditional qualities of drilling machines and drills suggested that this ought to have been a test to destruction of either the drill or the machine, or of both. What actually happened, however, was that the drill penetrated fifty inches of cast iron in one minute without damaging itself or the machine. All that was broken was the record for the rapid drilling of cast iron. The result of the test was therefore a convincing proof of the excellence of the design and of the materials provided by the British machine tool maker and the British manufacturer of special tool steels.

THE WONDERFUL "NIBBLER"

One of the most useful of the many new models shown at the Machine Tool and Engineering Exhibition held recently in London, was that known colloquially as the "nibbler." Almost every engineering shop finds it necessary at some time or another to cut sheet metal into certain shapes. When the shapes are simple and uniform the process presents little difficulty, but if a variety of odd shapes are required as occasion arises the ordinary methods of cutting are not conveniently applicable. Here the "nibbler" comes to the rescue. It is applied to the surface of the sheet and nibbles away a fine hole or slot so swiftly that by moving the sheet any desired outline can be cut as easily as a jig-saw puzzle can be cut in wood by a fret saw. When it is remembered that in some shops these out-of-the-way shapes are produced by the laborious and clumsy process of drilling or punching a series of fine holes, the handiness of this power-driven nibbler needs no emphasis. The Exhibition referred to was organized by the Machine Tool Trade Association and contained a magnificent display of the latest types of British machine tools.

HIGH SPEED PUNCHING

Thoughts of the boxing ring are aroused by the title: "The Laws of High-Speed Punching," which belongs to a paper prepared by Captain Tresidder for the British War Office. It deals, however, with a more formidable kind of struggle, as it investigates what happens when a projectile pierces armor-plate. More than a military interest attaches to this question as Captain Tresidder has found that the laws which apply to a shell going through armor plate are the same as those concerned in the ordinary engineering process of punching holes. The extraordinary interest of this problem is suggested by the fact that a candle fired like a bullet will go right through a wooden board without changing shape. Another striking fact is that a 12 inch plate must exert 60 million horsepower in order to stop a 15 inch shell at a range of ten miles. This enormous power is exerted only for one five-hundredth of a second, but in that brief space the plate does more work than a 33-horsepower engine can do in an hour. Many results of great scientific and engineering interest have been attained by the author of this paper, who has worked out an entirely new theory of what happens when a projectile drives a hole through solid steel.

CLIMAX KNEADABLE METALLIC PACKING

The Climax Kneadable Metallic Packing is another line carried by the Climax Company, and is also universal in character, as it is applicable to every class of service. It is equally efficient in extremes of temperature or pressure, steam engine or refrigeration work, revolving or reciprocating rods and pumps of every description. It is not necessary to provide various sizes of packing to meet the different needs, as the Climax packing can be kneaded into any shape, size of style of gland or stuffing box. It is claimed that the packing never burns or even gets hot, does not harden or crystallize, and is non-destructible, as it can be used over and over again. It is composed largely of asbestos and graphite, and, therefore, is self lubricating. It is easy to get in and easy to get out, and is extremely efficient under severe service.

MONSTER FLOATING DOCK

One of the largest floating docks in the world has been towed from the east coast of Scotland to a shipyard in Holland which is under British control. It was built during the war, and when completed was at once commandeered by the Admiralty for use at a naval base. Ships of ten thousand tons can be raised in this dock, which proved extremely useful in the rapid repair of vessels at the base. It is five hundred feet long and seventy-five feet wide inside, and it is built in three sections, each of which can be made a complete box dock. With this arrangement any two sections can lift the third out of the water when painting or repairing has to be carried out. The three sections are bolted together to make a complete dock. Three powerful ocean tugs were required to take the dock across to Holland, and in spite of bad weather the voyage was safely accomplished. Within three days of its arrival the dock successfully lifted a ship, and since then it has been continously engaged.

MARINE ENGINEERING

AND

Canadian Merchant Service Guild Review

A monthly journal dealing with the progress and development of Merchant and Naval Marine Engineering, Shipbuilding, the building of Harbors and Docks, and containing a record of the latest and best practice throughout the Sea-going World.

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The Deep Waterway Scheme

THE International Joint Waterways Commission found but little sentiment in favor of the undertaking among shipping interests in Montreal. Mr. Robert Reford, for the Shipping Federation, stated that after deep study of the question, they were prepared to go on record as being decidedly opposed to the scheme. The reasons given were that navigation requires all the depth of water that can possibly be obtained in the St. Lawrence, and further, that no well defined plan had as yet been laid down for consideration. Under these circumstances, the Federation felt that no work should be done on the canals until this plan was forthcoming.

The point of their objections seems to lay in the opinion that no matter what work is done in deepening the canals, ocean traders would never be inclined to avail themselves of them. This seems to us to be a fairly good summing up of the whole matter. It is extremely doubtful if any shipowner would care to send a vessel up through hundreds of miles of inland navigation, much of it through canals where locking is necessary, with its attendant delays. If he did, he would probably have to put enough extra on to the freight to cover the added expenses, as to make it uneconomical to ship grain by the route. It must be borne in mind that the lake freighter is the product of many years' experience in her particular purpose, and can probably carry grain and other bulk cargoes much cheaper than any other type of vessel in use. The deep sea vessel carrying grain has to be trimmed, besides using shifting boards, all of which adds to the expense. She takes longer to load, and while it is quite true that this will take place at the ocean port just as well as it would at the lake port, the presence of a large number of ocean ships at the head of the lakes instead of the typical lake grain carrier would result in congestion at that point. To make canals deep enough to allow the big lake freighters to reach Montreal would be a feasible proposition, but a system of canals to allow of the large deep-sea cargo vessel, with her much greater draught, proceeding to the head of the lakes, would be a different matter.

The further point taken that the development of the power schemes might react adversely on the navigation and ice conditions in the St. Lawrence is another highly important one. It is claimed that the result of the Chicago Drainage Canal has been to lower the water in the St. Lawrence Channel a matter of 6 inches. The proposition is too big, and affects Canada too much as a whole for it to be left in the hands of enthusiasts, who see only local interests. A definite scheme should be forthcoming, and the country made acquainted with it before any decision is arrived at. Canada has enough white elephants on her hands at present without adding to the circus.

A Better Attitude

IN distinction to the spirit of selfishness and lack of consideration of any interests but their own shown by some branches of organized labor is the stand taken by the members of the British sailors and firemen's union, with reference to their demand for an increase in wages. The claims put forward were for an increase of 5 pounds per month for sailors and firemen in deep water ships, and 30/- a week in weekly vessels in the coasting trade. A weekly ship is one in which the members of the crew are paid by the week, and the pay is made sufficiently large to cover living expenses, the crew buying their own food. This arrangement is in force in practically every coasting steamer and tug boat on the coast of Great Britain and Ireland. The advance was a considerable one, but a meeting of the Maritime Board was called to consider it, and the actual state of the shipping business was put before the men's representatives. The shipowners on the board pointed out the heavy working costs of their steamers, the lack of outward cargoes, and the fall in freights. They produced actual costs to show just what the proposed increase would mean to their business. The result was that the men's representatives agreed to defer their demands for two months, and if by that time conditions had improved, they would bring them up again for consideration.

This is an excellent sign, and it is to be sincerely hoped that the same spirit will gradually extend to other unions. British shipping is engaged in a very uphill fight just now, and the action of the miners has deprived it of a very large portion of its income. There is no doubt at all that the seamen and firemen will stand an excellent chance of receiving the increase asked for when the time is ripe, and it will be given with all the better grace in view of the men's reasonable and considerate action.

An Unpleasant Experience

A RECENT news item contained an account of an action brought by the parent of a boy who had been inadvertently locked in one of the cold rooms of a packing plant for a period of twenty-four hours. The result of his imprisonment was to make him lose his reason, and substantial damages were sought by way of compensation. Of course, no monetary compensation could ever make up for the loss of reason, though it might, to some extent, for loss of earning power. The item recalled another incident of the same kind which did not end fatally,

but gave the actors in it a very bad time for a few hours. The manager of a packing concern and his consulting engineer were making a tour of the cold rooms in the plant, and towards late afternoon entered a room the temperature of which was about 4 degrees above zero. The room was entered through an air lock, the doors being without handles on the inside, and as they did not intend to be more than a very few minutes inside, the doors were just pulled lightly to, without being fastened. Evidently no one saw them enter, but someone passing by noticed the doors were not tightly closed, and very carefully entered the air lock, and closed the inner door, and retired, closing the outer door after him. The two men inside having finished their inspection, arrived at the door on their way out and found to their horror that they were imprisoned. There was no means of communicating with the staff in the engine room, and no likelihood of anyone visiting the room for the next eighteen hours. There was, on the face of it, an excellent probability of their frozen carcases joining those put in there on purpose. The plant manager, unused to facing emergencies, promptly collapsed and became, for the moment, incapable of thought or action. The engineer, possessing a greater amount of self-reliance and initiative, promptly began to canvass means of escape. The doors were of one-inch wood, laid on studding, with an air space, making two thicknesses of one-inch flooring board, and the air space was tightly packed with insulation. Looking around the room, they were fortunate enough to find a piece of 4 by 4 lumber, which had been left inside by a providential piece of carelessness on someone's part. With this as a battering ram the inside door was attacked, and, after working in relays for about two and a half hours, an opening was made in the inner door large enough for them to reach through and knock the handle open. They were thus half-way out, and by this time fairly well exhausted. Their exertions with the battering ram had, of course, served to keep them from freezing, but in the intervals of working they cooled off rapidly, and while at work carried on with feverish energy. The same good luck which had attended their finding of the batten again came to their aid, for the first thing the engineer saw when they got in the air lock was an expansion valve on the cooling coil for that room. Here he had an excellent means of calling somebody's attention to their plight, and he promptly availed himself of it. He opened the expansion valve wide, and the natural results in the engine room brought a puzzled engineer in quick time to look for the trouble. His surprise when, on opening the door, he was confronted with his bedraggled and very much frightened employer may well be imagined. That particular plant manager will not go into a cold room for any consideration that can be mentioned since that day, and he was many weeks before fully recovering from the experience.

Neither of these cases should have happened if ordinary precautions had been observed. It should be a fundamental principle among men whose vocation takes them into such positions to observe ordinary precautions. No man should enter a vault, cold room, steam boiler, gasoline tank, or any other place where he is liable to be inadvertently locked in, or become overcome with gas fumes, or scalded by the opening of a valve, without stationing a man at the entrance, with instructions to stay there till they come out. It is not always convenient to do this, but a bit of inconvenience is not to be balanced against danger to human life. Safety first is an excellent motto, even though, like many other good things, it is carried to ludicrous lengths by some enthusiasts. Presence of mind and resourcefulness are excellent qualities to get one out of a tight hole, but the same qualities exercised before getting into the hole obviate the necessity of getting out. Prevention is better than cure.

100,000 Revolutions Per Minute

THE present-day tendency towards ever increasing speed has been often deplored by the more staid and conservative elements of the community. Where the endeavor to procure speed has only been actuated by a desire for new sensations, this disapproval is, perhaps, well merited. All speeding-up processes are not developed with such meretricious objects, and in the field of industry speed is a desirable thing, both in general production and in the details which make rapid production possible. From this necessity have arisen the various high speed machine tools, and high speed cutting steel, with which we have all become familiar in recent times.

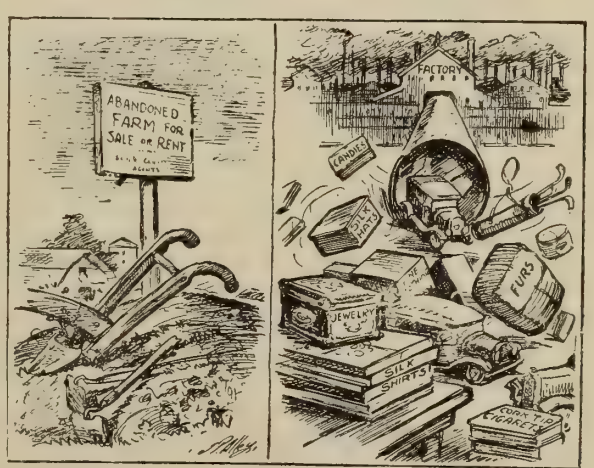
To what extent this tendency has developed was forcibly brought home to us by an account of a high speed grinding spindle attachment recently exhibited by a well-known British firm of tool makers. Grinding is one of the operations in metal working where speed is of great value, and especially on small internal work, such as lapping gauges, internal tapers, bushings for precision tools, etc. The wheels employed are of necessity very small, and this permits of the attainment of high speeds. The higher the speed of the abrasive surface, the less tendency will there be for the surface of the metal being dragged, and thus roughened, a condition strictly to be guarded against.

Practice in grinding had reached a point where these wheels had been revolved at 75,000 revolutions per minute, which is a very respectable rate for any spindle to revolve. The spindle we are alluding to exceeds this speed by 33 1-3 per cent. That is, it is guaranteed to be capable of running safely at 100,000 revolutions, and has been run at a speed of 104,000 revolutions per minute.

This is getting to a point where the mind fails to grasp the significance of the figures involved at the first glance. Try to picture a small spindle and the wheel mounted on it which makes a complete revolution in just .0006 of a second. If the spindle on which the wheel is mounted is one-half inch in diameter, its circumference would cover a distance equal to 13,090 feet, or almost 2½ miles per minute. A locomotive with a 5 foot diameter driving wheel would have to turn that wheel 833 times a minute to attain the same distance in the same time. The spindle, of course, will, on the smaller sizes of wheels, be of less diameter than one-half inch, because it is very obvious that with a wheel of ½ inch or ⅝ inch diameter, one could not well have a ½ inch spindle.

The wheels for this speed must be of good construction, for they will have to resist the force tending to tear them apart, due to the speed. Of course, they will be of no great weight, probably averaging 2 to 4 ounces. Suppose the wheel weighs only 2 ounces, and is of one inch diameter, the force tending to make it fly off at a tangent, or the centrifugal force, would be equal to about 18,000 lbs.

These figures seem hard to realize, and they serve to show what has been reached in engineering practice when such speeds can be employed with perfect safety. There can be no doubts as to the material employed, or the manufacturing methods used, when speeds of one hundred thousand revolutions per minute can be guaranteed.



PROSPERITY!

—Alley in the Memphis "Commercial Appeal."

News of The Shipping World

SINCE our last issue the threatened strike of the coal miners in England has become an accomplished fact, and at the present time of writing there is no sign of a settlement. The men are evidently completely under the sway of the extremists and can see no further ahead than the immediate gain of so much per hour, for which they are not willing to give a fair return in labor. Their absolute refusal to consider any question of increasing production seems to be evidence of their determination to kill the trade if they cannot have it for themselves. We sincerely hope that the Government and the British public will stand firm on this issue, and make it plain that the whole nation cannot be ruled by any section, no matter how turbulent they may be.

* * *

THE immediate effect of the strike is being reflected in the closing down of shipyards and steel works all over the country, while the indirect effect on shipping was felt before any other interest suffered. An immediate curtailment of bunkering facilities to all ships other than British was put into effect as soon as the men quit work, while an embargo was placed on all export coal. This immediately deprived an immense number of British ships of outward cargoes, giving them the choice of long voyages in ballast or of tieing up till better times came. Quite a number of vessel owners chose the latter alternative as being the easiest way out for the present. The ultimate effect of stopping the export of coal from Great Britain will be reflected in still higher costs for all the necessities of life in the country that have to be imported, and a falling off of general industry, while the way is left clear for Britain's foreign competitors in the coal trade to step in. Coal is the keynote of British prosperity, and anything that interferes with the production and export of coal upsets the whole industrial life of the country, and is reflected in other countries which depend to a more or less extent on British coal to supply their fuel needs.

* * *

THE agreement that has been come to between the interests represented by Mr. A. W. Harriman and the Hamburg American Line has caused a lot of excitement in and out of United States shipping circles. Much criticism has been levelled at Mr. Harriman for having anything to do with the German company, which, strictly speaking, is still an enemy concern. He was accused by some of having made a secret agreement with the Hamburg American Line to the detriment of American shipping interests, but Mr. Harriman has explained his actions in such a way as to satisfy most of his critics that at least he had no intentions of betraying American shipping into the hands of the foe. Mr. Harriman has kept Admiral Benson, that truculant war horse of the Shipping Board, fully advised as to the negotiations as they have progressed, and Admiral Benson has been perfectly satisfied. It may be remembered that Admiral Benson was never very clear as to which side the United States was on during the war, and naturally he would not be likely to be upset over a mere commercial agreement with an enemy firm. However, the shipping public of the United States are inclined to think that there is little harm in the business, but would prefer that Mr. Harriman had arranged the German agencies of his steamship company without bringing himself into touch with the Hamburg American officials. There will be probably some very spirited questioning in Congress when it meets as to the new arrangement, as it gives the very chance that the astute politician requires to gain some cheap notoriety and the sympathy of the 100 percenters.

IN another part of this paper we publish an extract from the London (Eng.), Observer, which contains the views of that paper's shipping correspondent on the Canadian Government Mercantile Marine. It is a very flattering tribute that he pays to the fleet itself, and to its operation and management. He comments on the accommodation given to officers and crew on the "Canadian Victor," a fact which we commented on at the time of the vessel being in Montreal. The management's policy of co-operating with the large shipping firms, such as the Cunard Line and Alfred Holt's, is also a cause of favorable comment from this friendly observer.

* * *

THE figures for the trade of the Port of London recently issued contain some points of interest, and show how the port is getting back to a normal basis. During the war, due to geographical position, the port of Liverpool got some distance ahead of London in volume of trade, but the latter port is fast regaining her position of supremacy. The total net tonnage of vessels arriving and departing during the twelve months ending Dec. 31st last, both with cargo and in ballast from and to British possessions and foreign countries, was 26,335,191, an increase of nearly 12,000,000 tons over the previous year. The total value of imports and exports, excluding coastwise goods, for the year 1918 was 1,848,514,981 pounds and for 1919 was 2,589,540,889, an increase of 40 per cent. for the whole of the United Kingdom. London's share of this was 541,909,302 pounds in 1918, and 819,875,330 pounds for 1919, an increase of 51 per cent. The report conveys the pleasing information that while congestion still occurs, conditions are getting back to the normal very rapidly.

* * *

THE coming of keen competition in the ocean carrying trade is reflected in the movements of the American Shipping Board vessels, many of which are being returned to the board by the companies operating them. The amount of tonnage of American vessels compared to foreign entering and leaves United States ports show that foreign tonnage is gaining in every trade but the North Atlantic. Thus in January the American tonnage comprised nearly 50 per cent. of the total, and in February was over that figure. It began to decline in June, and in July was only about 47 per cent. In July the only trade in which American owned vessels exceeded those of foreign countries was in the trade with North and South America, while in the European trade foreign vessels outnumbered the American vessels by nearly 2½ to 1.

* * *

THE United States Shipping Board is meeting with little success in its efforts to sell its wooden fleet. When the bids were opened on October 8, at which date tenders were supposed to be in for 318 vessels, only four were received and the total amount offered was only a little over $110,000. As these vessels cost about $210 a ton to build, there was not much profit in this. It looks now as though all these vessels that were built under the wooden shipbuilding programme will be a dead loss. Many of them require extensive repairs, but even if put in good order, they cannot compete with steel vessels, being handicapped by their greater displacement in proportion to their deadweight capacity. Many of them have not yet received their machinery, but the greater majority have been thus fitted. The total loss will likely be in the neighborhood of $200,000,000. This should finally settle the controversy which raged so long between the advocates and antagonists of the famous wooden ship programme.

THAT the German still retains his pleasant little peculiarities is evident from the report of the burning of the steamer "Bismarck" in the yards of Blohm & Voss, Hamburg. The "Bismarck," which was to be the world's largest liner, of over 55,000 tons displacement, was to be surrendered to the Allies under the Versailles treaty. The vessel was practically burnt out and she is the latest of a long list of German vessels which have been burnt, as is shrewdly suspected, by German agents, to prevent their delivery to the Allies, and particularly to Great Britain.

* * *

THE freight market is strong in some quarters, and uncertain in others. Many steamers got away from the United Kingdom coal ports at the earliest rumors of the coming coal strike, with the result that those which remained are able to command a good price for coal cargoes to Continental ports. Rates from United States ports to Europe for coal have fallen off somewhat, and with a very moderate demand may fall further. If the coal strike continues very long in Great Britain there may be a demand for steamers to carry coal from U. S. to European ports to make up for the loss of British shipments. There has been a dull market from River Plate ports to Great Britain and Continent, but this shows signs of getting firmer. The drop in rates is no doubt caused by the large amount of tonnage which is bound out for the Plate ports with coal from both U. S. and England, which will be available for return cargoes. A steamer was fixed for prompt loading, San Lorenzo to U. K. or Continent for 95/-. Rates from nitrate ports have been fixed from Oct. to Nov. loading, 105/- U. K. or Continent. Rates from North American and Canadian ports have kept firm since our last writing and there has been a fairly active demand for coal carrying tonnage. Rates from the usual northern range ports to Rotterdam and French Atlantic ports have been $12 and $12.50, and to Mediterranean ports $14.50 to $15. There has been a good demand for tonnage to North African ports, and 17/- per quarter has been the prevailing rate. Grain from the North Pacific ports to U. K. has been fixed at 110s., and 115s. to 120s. with option of Mediterranean. Time chartering is quiet, tonnage for the Trans-Atlantic coal trade being available at 14s. for six months, with delivery in U. K. or U. S., while a small steamer has been fixed for the Mediterranean at 20s. for six months trading.

* * *

CONSIDERABLE indignation has been expressed by British ship owners at the manner in which the New York port authorities allow the dockside workers to distribute literature calling on all workers to cease work on British ships. These circulars are couched in very violent language, such as "British pirate laws rule the high seas where the American flag flies," "Stand clear, and let British ships rot. Work any ship but a Britisher." This sort of thing does not reflect any credit on the authorities who either openly allow it, or tacitly connive at it. One of the leading British papers characterizes these circulars as being a dockside edition of the Jones Bill, which is a pretty apt description at that.

Exporters Should Study Conditions Closely

South Africa is Well Advanced in Many Lines of Practice—Some Cases Where Exporters Have Made It Very Hard for Their Goods to Be Favorably Considered.

FIRST hand information on the requirements of importers in the overseas countries and their experiences with goods of various countries is always of interest to the manufacturer who is interested in export trade. Recently "Canadian Machinery" had the opportunity to speak to a South African engineer, who is visiting the United States and Canada to interview the firms whose goods his company handles out there.

This gentleman's firm imports and erects refrigerating machinery, steam engines, electrical apparatus, general engineering supplies, and also some agricultural machinery. Incidentally to show that the South African farmer is moving with the times, this one firm has supplied over 1,600 sets of farm lighting equipment of a well known American make. They have supplied a large number of steam driven electric lighting sets to various municipalities, there being little water power available, except at the Victoria Falls, and they are far too distant to be useful. Oil engines they do not recommend for South Africa, as the fuel has to be imported and the necessary skilled help is not always available. A large number of air compressors are used in South Africa, and these are mostly obtained from England. Engines are bought both in the United States and England, and steam boilers from Great Britain alone. We aroused our informer's interest greatly when we informed him that he could procure boilers in Canada that would compare with any boilers he could obtain in any other part of the world, and he expressed a desire to visit some of the firms we mentioned and see for himself. On the subject of engineering brass goods, he informed us that Australia could in the matter of price, quality, and delivery, give points to either Great Britain, United States, or Canada. This was particularly true of small brass valves, from 1-4 inch to 2 inches.

Poor Shipping Practice

Speaking about shipping practice, our friend waxed eloquent. In fact he said that one of the principal reasons for his long trip to this continent was to try and get a proper understanding on the part of shippers as to how their product should be packed. His firm, he said, had lost thousands of pounds in the last few years by reason of extra charges on railways and lighters due to wrong packing. Asked for specific instances, he related one of a steam engine about 18-in. x 24-in. stroke, which was crated all assembled in one huge crate, and cost them hundreds of pounds in extra charges before delivery was made. In another case the very opposite mistake was made. This was a shell brine cooler, which of course consists of a tank with a coil inside. The tank, which could not come to much harm even if uncrated, was carefully crated, and the coil was removed from the inside and packed in another crate. He gave other instances where either too little or too much crating was used, and declared that endless correspondence did not seem to help matters. This trouble was not experienced with goods shipped from Great Britain, but was very noticeable with American and Canadian manufactured articles. On arrival at South Africa an extra large crate would have to wait weeks before a car could be procured to ship it on the rail, and then in some cases it would have to be shipped for many miles by road. This meant much delay. In some cases crates had been shipped that were too large for the ship's gear to handle, and this meant that special cranes had to be used both for loading and unloading.

Regarding locomotives, American made engines had not been very successful in South Africa, trouble being experienced in the copper fire boxes. The South African Government require this type of fire box, and those of American manufacture did not seem to stand up as well as those of British manufacture.

Engineering practice is well advanced in South Africa, and one plant was mentioned that is in course of erection where the steam pressure used will be 350 pounds per square inch.

Want a Motor. — The Preston Woodworking Machinery Company, Preston, are in the market for a used 7½ h.p., three-phase, 25-cycle, 550 volt, 500 r.p.m. motor.

Enquiries into Marine Disasters

RE STRANDING OF S.S. "EDWARD PYKE"

IN the matter of a formal investigation into the stranding of the tug "Edward Pyke," some little distance east of Pt. Piseau, Harbor of Quebec, whilst towing the sailing vessel "Grand Duchess Maria Nicolaerna," on September 5th, 1920, held at the Court House, Quebec, P.Q., on October 7th, 1920, before Captain L. A. Demers, F. R. A. S., assisted by Captain Charles Lapierre and Captain J. Couette, acting as assessors.

Captain Axel I. Larsen, of the tug "Edward Pyke," stated that the vessel was 100 feet long, 21 feet beam, 8 feet draught, with twin screws, that he engaged a pilot at Quebec as he required a rest. He had never taken a pilot before as he knew the river. He was at the wheel whilst the pilot was directing the courses. He had about 500 or 600 feet of hawser out whilst towing the sailing vessel "Grand Duchess Maria Nicolaerna."

Report

Analyzing the evidence of the master, whilst steering his tug, or his ship, he obeyed the pilot's orders and upon receiving the instructions to go to the south he did so; a similar order was given three times, and at the third order the ship grounded; but came off ten minutes later. It was then felt that the propellor had suffered damages.

The pilot is the adviser of the master. In this instance the master was acquainted with the local conditions, and had taken the wheel. Why did he permit his vessel to skirt shoal places, especially in view of his towing a vessel drawing double the depth of the tug, viz., 18 feet?

Notwithstanding the fact that the pilot was on board the master's responsibility had not ceased, and he should have taken upon himself to haul more to the southward and follow a safe course for himself and the ship he was towing. Did he exercise all the requisite judgment when he received the indefinite order from the pilot to steer a little more south, which was repeated three times? The court is of opinion that he did not. They were not steering by compass; but by points of land. The north shore was enveloped in fog for half an hour; but not enough to obliterate the complete view of the elevated part of the shore.

Pilot Edward de Villers, branched in April, 1920, was in charge of the sailing vessel and stood forward. He noticed that the tug was steering dangerously close, and to circumvent any possibility of his ship grounding steered more southerly, causing the tow rope to describe an acute angle with the stern of the tug. He did not think he had any orders to give to the tug as there was a pilot there. The court differs with him and will state that being in charge of the vessel being towed he was responsible for the action of the tug, notwithstanding the fact that there was a pilot on board of the said tug.

Arthur Arcand, 37, ten years in possession of a pilot's license, was standing by the wheel of the tug, and gave the order to the master who was steering, to steer a little south, without looking or noticing if his orders were obeyed, and this on three occasions. It seems to the court that the order "a little to the south" is not a seamanlike order. Had he given the order to starboard and then when enough alteration had been made, to give the order to steady, it would have intimated an intention to perform his duty with some common sense.

He has shown a good deal of indifference in the performance of his task. Upon coming on board at six a.m. he at once went down to breakfast, and though the meal was not ready he awaited its coming, remaining below, or at least, away from a position where he could observe the course being steered. When he left King's wharf he was 600 or 700 feet away in the channel, and a course of W.S.W. was steered; but he had been told the steering compass was not correct, and that the standard had been adjusted; but the master could not tell how much it was out, beyond the fact that it had an error.

Where was the necessity of hugging the north shore whilst towing a vessel of 18 feet draft? It is the duty of the tug to act in such a manner as to keep himself and tow clear of all dangers, even if no orders are received from the tow. When he ordered an alteration to the south he never noticed the objects which were in view in order to see what angle the tug was making. It does seem that because the master was at the wheel he lost sight of his responsibility as a pilot. The accident in itself is trivial; but it points to a misunderstanding of responsibilities between master and pilot, one leaving to the other the guidance of the ship.

Summing Up

The court is of opinion that the master, Axel Larsen, did not exercise his prerogative as master; that when the vessel was being steered so close without any reason it was his duty to widen the space between his tug and the shore.

The pilot, Arthur Arcand, has shown a timidity, an unwarrantable diffidence in the exercise of his duty. His whole evidence points to the above mentioned situation.

With respect to the pilot Ed. DeVillers, the court is of opinion that he should have made some signal to draw the tug's attention, since he avers that she was running into danger. He ignored the fact that the tug was his servant for the time being. He showed lack of ordinary knowledge, common sense and judgment in this instance.

Finding

The court having carefully weighed the evidence adduced, finds, for the reasons expounded in the report, that both the master, Axel Larsen, and Pilot Arthur Arcand, failed to exercise that prudence that their respective positions and responsibilities obliged them to adopt.

The fact that the casualty in a monetary sense is trivial is of no concern to the court. It is the principle involved, the actions of each of these parties, which brought the tug and her tow into danger. Hence the court orders the master, Axel Larsen, to pay the costs of the enquiry, a statement of which will be furnished, within one month.

Pilot Arthur Arcand is fined $150, which shall likewise be paid to the accountant, Marine Department, Ottawa, on or before the 1st November, 1920.

With respect to Pilot Ed. de Villers, of the sailing vessel, though his ship did not come to grief, the tow rope being cast off in time, he is severely reprimanded and cautioned to remember that, if only in a humanitarian point of view, it was his duty to warn his servant that he was running into danger as he averred he noticed.

Rider

A very important point is brought out, viz., the fact that each pilot was under the impression that he had no instructions to give, or orders to receive from the other, that each was caring for his own charge, and felt that neither one had any concern for the other.

This is a wrong and dangerous policy if pilots, as the court is informed, intend to pilot each a tug and tow, and the powers that be permit it, stringent instructions and regulations must necessarily be at once issued in view of the above to prevent dual control, which can only be destructive to any policy and dangerous to the navigation on our St. Lawrence.

Read in open court at Ottawa, this 11th October, 1920.

(Signed) L. A. Demers,
Dominion Wreck Commissioner.

We concur
(Signed) Chas. Lapierre
(Signed) J. Couette
Assessors.

RE STRANDING OF SS. CLARA-HUGO STINNES 1

In the matter of a formal investigation held at Pictou, N.S., on October 14, 1920, before Commander H. St. G. Lindsay, C.O., R.N.R., commissioner, assisted by Captain W. A. Beattie, and Captain C. D. Fraser, acting as nautical assessors, into the stranding of the British steamer Clara-Hugo Stinnes 1 on Amet Shoal, Pictou County, N.S., at 12.20 a.m., September 30, 1920.

The British steamer Clara-Hugo Stinnes 1, of 3,099 tons register, official number 143064 of London—formerly of German register—apparently well found and equipped, carrying a crew of 36 hands all told, sailed from Miramichi, N.B., bound to Pictou, N.S., to complete loading for Manchester, on September 29, 1920, at 3.30 a.m.

Everything apparently went well until 11 p.m. on the same date, the weather being overcast and showery, when a light was reported ahead, which was first taken by the master, P. B. Nesbitt, Board of Trade certificate No. 00674, to be the light on Prie Point, P.E.I., which light he was steering to pass five miles off, the compass course then being S.E.½S.

On sighting the light the course was altered to S. by E. ¼ E. by compass, and at 11.30 p.m. the light was abeam but no bearing taken for distance off. At 11.45 p.m. land was sighted ahead and the helm was ordered hard aport and the vesel headed out toward the light. After consulting his chart the master decided that the light he had taken for Prie Point was Amet Island light and ordered the helm again to be ported with the idea of proceeding out to the southward of Amet Shoals, but being then too close to Amet Island the vessel grounded on the shoal south-east of the lighthouse, remaining fast until the morning of October 11, when she was towed off and taken into Pictou after having been lightened.

After examination in Pictou it was reported that the vessel was apparently not seriously damaged and reloading commenced on October 14th, 1920.

Finding of the Court

After careful consideration of the evidence which apparently was given in a perfectly straightforward manner, the court is of opinion that the stranding was caused by the vessel having been set to the southward of her course by the flood tide, which is very strong in the vicinity of Cape Tormentine, and was not taken into consideration when shaping the course after passing Cape Jourimain, and also, probably by the difference in the deviation allowed on that course, and that which ultimately was found by observations taken at a later date.

The court finds that the master, R. H. Nesbitt, showed a lack of judgment in not stopping his vessel and making certain of his position, either by soundings or bearings, after sighting land, for which he is severely censured.

The court would suggest that when masters of vessels choose to navigate the Northumberland Straits in preference to taking the outside route, they should avail themselves of the latest official publications regarding the tides, etc., in the Strait.

Read in open court at Sydney, N.S., this 16th day of October, 1920.

(Signed) H. St. G. Lindsay,
Commissioner.

Concurred in by

(Signed) W. A. Beattie
(Signed) D. C. Fraser
Assessors.

STANDARDIZATION OF MATERIALS

For the first time in Australia, systematic and comprehensive steps are being taken for the standardization of various materials used in industry. This question was taken up some time ago, quotes the "Commonwealth Engineer," by the Institute of Science and Industry, and the first Australian standard specification for the Commonwealth, relating to steel, used for structural purposes such as angles, tees, beams and channels, has now been published. This is the first of a number of Australian standard specifications which will be issued by the institute, which has already brought into line the views of both manufacturers and users as to uniform standards for not only structural steel, but also of railway rails and fishplates and tramway rails and fishplates. Standard specifications for the two latter will be published by the institute shortly.

REMARKABLE DROP IN OUTPUT OF CENTRIFUGAL PUMPS AFTER STARTING

Observations made by the author indicate that many centrifugal pumps show a gradual falling-off in efficiency after running for some time. Two characteristic cases are cited in connection with the large pumps used for pumping the Haarlem mere. In the first the output fell to 30 per cent. below the normal, and in the second case a marked increase in the energy consumption was noticeable shortly after the pump was started. On stopping and restarting the pump, the normal output and energy consumption were again obtained; but the conditions gradually fell back to those previously observed. After discussing the influence of a possible accumulation of gas (from the peaty soil) in the suction pipe, the author rejects this explanation as being insufficient. He ascribes the cause to the fact that turbine pumps of the Francis type are designed on the assumption that the inflowing water is moving in an axial and not a rotary direction. This assumption is undoubtedly correct during starting, but it can be readily demonstrated that very little would be required to impart a rotary movement to the incoming water column—i.e., the mass of water would move in a spiral through the pipe. This rotary effect would explain the phenomenon and also the fact that in turbine pumps with a high circumferential speed, and where little or no rotary motion would be imparted to the incoming column of water, this falling-off in output disappears. The author is of opinion that the transmission of this rotary motion from the rotor of the pump back along the incoming water column is considerably accelerated by the presence of large quantities of suspended matter in the water. The obvious solution of the difficulty for low-speed turbine pumps would be the introduction of a rib or ribs in the suction pipe, to prevent a rotary motion from being imparted to the incoming water column.—J. C. Dijxhoorn ("De Ing.").

NEW PUBLICATIONS

The Armstrong Cork Company, Pittsburgh, have issued a new publication, "Nonpareil Insulating Brick," a 72-page book on the insulation of high temperature industrial equipment, such as boilers, furnaces, stills, hot blast stoves, ovens, kilns, etc.

While dealing particularly with the description of Nonpareil Brick and their uses, the book is more than a catalogue. The subject of heat insulation has been thoroughly studied from both the theoretical and practical standpoints, and the results here compiled contribute to make this book a really valuable and instructive treatise. It is conveniently divided into sections, each dealing with a particular type of industrial apparatus so that any one can readily find the data for the equipment in which he is especially interested. Operating records, with and without insulation, are given, actual dollars-and-cents savings demonstrated, and the economy and advantages to be secured by the use of Nonpareil Brick described in a most interesting and convincing manner.

The book is attractively and substantially bound and profusely illustrated. Its subject matter is of such vital importance to all industries employing high temperature equipment, that plant managers, superintendents and engineers will find it a valuable addition to the technical library.

"THE PETROLEUM OUTLOOK"

What should prove of great interest to all persons genuinely concerned in fuel problems, is a monograph published by Arthur D. Little Inc., of 30 Charles River Road, Cambridge, Mass., and entitled "The Petroleum Outlook." The work discusses in plain language the status of all the oil fields and their present development, with future prospects. Several charts and a large map are included, showing the entire resources of the United States. The subject matter is highly interesting and gives food for thought. The monograph will be supplied free to those interested on application.

Steam Engine Development in the Maritimes

An Interesting Account of the Growth and Development of Engineering Practice in the Lower Provinces—Read Before the Enginering Institute of Canada.

By D. W. ROBB, M.E.I.C.

ALTHOUGH Nova Scotia, New Brunswick and Prince Edward Island, the Maritime Provinces of Canada, are more widely known for the extent and importance of their fisheries, lumbering, mining and some departments of agriculture, particularly apples, potatoes, etc., than for mechanical and engineering achievement, it is interesting to find that in the early development of steam engines for steamers, locomotives, and later in connection with electrical apparatus, a department of engineering which has contributed more towards the rapid progress of the world during the nineteenth century than any other; the little provinces by the sea were among the first on this side of the Atlantic.

When we remember that the first practical steam engines were built by Watt from 1775 to 1800, and that we are only now celebrating the centenary of Stephenson who started the steam locomotive on its triumphant career, it may surprise many of us to find that as early as the years 1844-48 and 1854, John Waring and John Smith, pioneer engineers of St. John, N.B., designed and built marine engines for steamers running on the St. John River. Stationary engines were built by Fleming & Humbert at St. John, N.B., as early as 1838, and locomotives were built by Mr. Fleming before 1860. One of Mr. Fleming's locomotives hauled a train for the late King Edward, then Prince of Wales, when he visited Canada in 1860.

It may be interesting to give a few particulars in regard to the steamers and engines referred to above. I am indebted to Captain R. Retallick of St. John, who has sent me, through Geo. H. Waring, grandson of John Waring, one of the pioneer engine builders referred to above, the following particulars:

The steamer "Reindeer," for service on the St. John River, was built in 1844. Her engines were compound, the high pressure cylinder being horizontal with Stephenson link motion and the low pressure cylinder oscillating. Captain Retallick states that this was the first compound engine that was run successfully (probably he means for marine service), but it must have been among the first compound engines built for any purpose. This engine was designed by Tippitts and Waring — built by John Smith at St. John, N.B., and must have been of good design and construction as it was transferred to the steamer "Antelope," also a river boat, in 1861 and later installed in the steamer "Admiral," which was broken up in the year 1915, so that this engine passed the scriptural "three score and ten."

The steamer "John Waring" was built in 1858 at Woodstock, N.B., by Mr. McConnel. The engines were built by John Waring, and had two high pressure cylinders. The boat was a side wheeler as the water is very shallow at Woodstock. The "John Waring" was launched under steam and came direct from Woodstock to Indiantown, just above the reversing falls at St. John, about 140 miles. She was considered very fast.

The next steamer, Captain Retallick states, was the "Anna Agusta," built at Fredericton. The engine was a horizontal low pressure, or single cylinder engine, placed on one side of the boat with the boiler on the opposite side and was built by Fleming and Humbert of St. John. She was a side wheeler also.

One of the earliest steamers was the "St. John," built at East St. John. She was a side wheeler. The engine was built by John Smith. Captain Retallick says it (the reciprocating part of the engine), looked like a saw mill gate or sash moving up and down. This boat was launched under steam and managed to paddle around into St. John Harbor under her own power, but the hull was so full aft that she would not steer. Later, after a new stern was added, making her about 24 feet longer, she worked satisfactorily.

George Fleming, of Dysart, Scotland, who served his apprenticeship at Dunfermline, grandfather of the present owners of the Phoenix Foundry and Locomotive Works, established at St. John in 1835, and built quite large marine engines for service on the St. John River, Bay of Fundy, and later for the Prince Edward Island service—two of these boats, the "Rothesay" and "David Weston" for river service, were famed all over Canada for their speed. The old records of the company show that Mr. Fleming supplied an engine to Brazilian Ansley in 1838, price 250 pounds, and in 1840 an engine and malt mill for 225 pounds, and an engine for George Younger, price 180 pounds. The Flemings are said to have built the first steam fog whistle used in any part of the world, which was designed by a St. John man, and was placed on Partridge Island, St. John Harbor.

In the early sixties and seventies, a number of well known engineering concerns in the Maritime Provinces built stationary steam engines for the many large saw mills in New Brunswick and Nova Scotia, as well as for factories, mines and various other purposes. Among the most prominent of these may be mentioned, Geo. Fleming & Sons, John Smith, Harris & Allen, and Allen Brothers, of St. John. The Pictou Foundry, established by Mr. Davies, Sr., in 1854, who came from the old country as master mechanic of the General Mining Association—I. Matheson, formerly located at Chatham, N.B., and later at New Glasgow, and his son W. G. Matheson. The Truro Foundry and Machine Company. The Burrell Johnson Iron Works of Yarmouth, N.S., which built tug boats and small steamers, marine engines of considerable size, waterworks engines, etc. The Montgomery Iron Works at Halifax and Moir Symonds. The Montgomery company built a few locomotives which were used on the Intercolonial Railway.

From 1885 to 1890 the use of electric power for lighting, tramways and other purposes began to develop extensively in the United States and to some extent in Canada. Among the first to foresee and take advantage of the increasing demand for improved high speed engines, suitable for driving electric dynamos direct from the engine shaft, was the Robb Engineering Company, of Amherst, N.S. This concern, working in collaboration with the General Electric Company, Westinghouse Company, and other manufacturers of electrical apparatus, succeeded in producing combined steam engines and electric machine in compact form, adapted to the various services for which electricity was required. The first of these engines was designed and built by the Robb Engineering Company at Amherst, N.S., in 1890-91 under the direction of E. J. Armstrong, who was a pupil of the late Professor John E. Sweet, of Syracuse, New York, one of the best known designers and builders of high speed engines and a great educationist in mechanical engineering.

Mr. Armstrong was able, during the few months he spent at Amherst, through his thorough knowledge of the interchangeable system used in building high speed engines and his natural ability as a draftsman and shop instructor, to organize a department of the Robb works so that they were able to build, with Maritime Province boys, engines for electric service which were equal to the best produced in the United States or elsewhere. He also enabled this Canadian shop to develop its own steam engineering and drafting departments in which engines were designed and supplied for electric work, not only throughout Canada, but, being among the first

in this field, was able to furnish engines of this type to Great Britain, Spain, Australia, India, South America, British Guiana and several of the West India islands. The exceptional compliment was paid to these works of receiving an order for a compound electric engine for use and educational purposes in the Manchester Technical School at Manchester, England.

The steam turbine has to a considerable extent supplanted the reciprocating steam engine for large electric units where steam furnishes the motive power. Oil and gas engines are making considerable headway for the smaller units and to some extent for marine use.

The tremendous development of water powers in Canada has also restricted the use of steam engines for electric production, but as yet the marine field is to a very large extent held by the steam engine. In passing it will no doubt be of interest to mention that the triple expansion engines to be installed in Nova Scotia's two largest ships, 8,100 tons each, were built at Amherst. One of these ships the "Canadian Mariner" was launched from the Halifax Shipyards on the 4th of September, and the other is well advanced in construction.

There is no doubt that steam engines will continue to be built and used for ship propulsion for some time to come, or until the rapid changes constantly taking place in engineering construction bring forth something better or more efficient and economical.

SUGGESTED LECTURES ON OIL FUEL

(1) The marine internal combustion engine is usually supplied with liquid fuel, i.e., oil. Oils differ in quality as well as in thermal value. Natural supplies, their difference. The engine room value of oils. Heat value dependent upon the density, viscosity and flash point. Tests easily applied to determine these several qualities. Storage in bulk. Tanks, valves and pipe systems suitable for different qualities. Troubles that may occur in consequence of defective storage tanks, valves, pipe systems and their relative positions to the engines. Leakage of oil, gas, presence of water, dirt, sluggish flow, etc. How detected and remedied.

(2) The internal combustion engine for efficient operation must convert the liquid fuel supplied into gas. The engines are therefore conveniently divided into groups, dependent upon the character of the fuel available. The evaporation of liquid requires heat. Hence the types usually constructed are: (i) Engines using petrols, which evaporate at ordinary atmospheric temperatures, and do not require any special supply of heat. These engines are supplied with carburettors and special ignition gear. Moderate compression because the combustible mixture is compressed.

(ii) Engines using paraffins, which only very closely evaporate at ordinary atmospheric temperatures and therefore require additional heat to effect evaporation. These engines are supplied with vaporizers and special ignition gear. The compression is moderate because the combustible charge is compressed. (iii) Engines using heavy oils, with considerable compression possible because only air is present during compression, the oil being injected by means of a pump at the instant combustion occurs. There are two types of this class: (a) That in which the temperature, due to compression is high enough to ensure combustion (Diesel engines); and (b) that in which the compression is loss, and combustion occurs by reason of the oil being injected upon a hot plate, heated externally at the start, but maintained by the heat of combustion whilst running (the hot bulb engine). This type is the "surface combustion" type, the previous two being gaseous mixture.

Principles of conversion of heat energy into mechanical, energy effect of heat upon matter. Expansion. Change of volume required in working substance to produce motion. Internal combustion engine employs some gas mixture, or liquid converted into gas by heat to obtain this motion. Principles of combustion. Surface combustion. Tests for perfect combustion. Remedies for imperfect combustion. Effects of richness of mixtures. Effect of compression upon combustion. Ignition. Products of combustion. Their composition, and simple analysis by the Orsat apparatus and interpretation of results. Bearing upon working.

(3) The importance of correct mixture. Carburettors: Functions, to evaporate petrol at rates varying from light load to full load; to draw in suitable quantity of air to give best mixture with petrol, and to mix air and vapor completely and uniformly. Jet and surface types. Choke tubes. Float regulator. Jets. Wicks. Throttle valves.

Vaporizers: Different types for process of vaporization and mixing of air and vapor previous to compression. Function the same as carburettors but employed for oils requiring a supply of heat to effect vaporization.

Surface combustion engine type of vaporizers or hot bulbs.

(4) Schemes of operation. Object sought alternate expansion and contraction, i.e., a cyclo. Usual cycles employed are complete in either two or four strokes. Valves required for four strokes cycle. Advantages and disstrokes cyclo. Advantages and disadvantages of these cycles. Valveless types. Modifications of valves for different fuels.

Methods of operating valves. Cams and cam shafts. Timing of valves, variations due to speed of rotation, etc. Scavenging—how carried out, the results obtained. Indicator cards show the effects of good and bad timing. Incorrect mixtures. Character of combustion. Size of valves. Rate of lift and closures. Throttling and its effects. Adjustments possible for correcting faults.

Fuel injection valves. Conditions under which it is possible; effect of friction. Troubles and their remedies.

The fuel supply per carburettor, vaporizer, by solid injection (hot bulb) or by air-blast (Diesel). Throttle valve regulation for the former, the latter pump, controlled by governor. Various types of mechanism connecting valves and governors. Size of valves. Timing. Opening. For Deisel type, atonization required. Air blast. Varying pressure. Defects affect combustion. Viscosity of oil. Cold temperature sluggish flow, dirt may cause block. Small openings great friction results behaviour of pump and engine will show cause of trouble, etc.

Marine work requires some additional mechanism to effect reversal of rotation. Cam shaft and cams one reason of difficulty. The several types of gear most usually employed. Two cam shafts. Two sets of cars. Gearing to effect reversal. Clutch gears. Reversing. Propellers, etc. Starting gears. Compressed air gears.

(7) Marine engines. Flywheels. Thrust bearings. Horn tube and gland. Propellers. Relative positions of several parts, location of fuel tanks with reference to engines, the piping arrangements for heat oils to facilitate flow. Consumption of oil and trim of vessel.

(8) Lubrication arrangements. Open and closed crank pits. Gravity and forced systems of distribution. Schemes of gearing to effect starting, stopping of reversal promptly. From the platform. Gauges and other indicators necessary for convenient regulation. Possible of speed for regulation. The more usual troubles experienced in running, their detection and remedy.

The Institute of Marine Engineers propose to publish the papers and discussions, and the council will for this purpose edit the matter to avoid repetition which may be unavoidable under the circumstances.

The October issue of the "Aeronautical Journal," the official organ of the Royal Aeronautical Society, 7 Albemarle Street, London, W.1, contains an important paper on Wire Ropes, by Mr. Walter Scoble, which is of great interest to the engineering profession generally. During the war Mr. Scoble was engaged at the East London College upon work for the Admiralty in connection with the anchoring cables of kite balloons, and it is the result of these researches which is now published. The scope of the paper is of such a wide and general nature that it is of interest to all engineers who use cables for winding and driving work.

The same number of the journal also contains an important paper by Mr. Harris Booth on "The Designs of Spars With Off-Set Pin Joints."

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ALCOHOL MOTOR FUEL RESEARCH

Vigorous efforts are being made by British men of science and engineers to discover all the possibilities of alcohol as a motor fuel. The increasing scarcity of petrol, and the prospects that the supplies from all visible resources will gradually shrink until they disappear in twenty-five years or so, lend a special urgency to the problem of finding a cheap and plentiful substitute. Realizing how serious the situation was, the Royal Automobile Club and the Commercial Motor Users' Association, both of Great Britain, united in paying the cost of an ambitious programme of research, at the University of Manchester, into the value of alcohol as fuel. At the request of the Alcohol Motor Fuel Committee, appointed by the British Government to survey the whole question, the programme was put in the hands of Professor Dixon, who recently gave the results of his investigations in a lecture delivered in London. A scientific study was made by Professor Dixon and his assistants of the behaviour of alcohol and of mixtures of alcohol and benzole after ignition. The main object was to find out the conditions which would give the highest efficiency with existing internal combustion engines when run on alcohol or alcohol mixtures. Information of the greatest value to designers has been collected. Investigations in this field have extended to the value of potatoes, beet, maize, and other sources of power alcohol. It is quite possible that many tropical and subtropical plants which have hitherto been regarded as a nuisance or as of little value will prove to have a high yield of the substances out of which, by fermentation, alcohol may be produced in large quantities at a low price. The research now being conducted may therefore be the means of transforming the economic prospects of more than one country.

COAL RESEARCH

The economical use of coal is a problem which concerns engineers in all parts of the world. It is especially interesting in connection with the "carbonisation" of coal at temperatures in order to obtain smokeless fuel, gas, oil and numerous valuable by-products. This problem involves a close scientific study of exactly what happens to different kinds of coal at various temperatures. Mr. Sinkinson of the Imperial College of Science, London, has hit upon a most ingenious method of discovering at what temperature coal begins to change into coke. He makes use of the fact that coke conducts electricity, while coal does not. By measuring the electrical resistance of a sample of coal as it is gradually heated he has fixed the temperatures at which various coals enter into the critical stage at which they give off their valuable products.

ROTATABLE COAL HOPPER

Firemen on big locomotives find promise of lightened work in the rotatable coal hopper that has been invented for engine tenders. This invention is so planned that the coal is kept handy at the firing deck, making it an easy matter for the firemen to reach the coal without shoveling from the rear of the tender or using power apparatus. This special hopper is in the form of a great segmental tub, or drum, having a diameter that is the approximate width of the tender. This drum is inclined toward the firing deck; it is so mounted on a ball-bearing centre plate as to turn readily. In its outer wall are openings, one for each segment, through which the coal falls by gravity. As soon as the coal is emptied from the segment, the brake that controls the drum is released. Naturally the greater weight above the centre of the drum makes it rotate, bringing the next loaded segment into position.

The full-rigged three-masted sailing vessel, Grand Duchess Maria Nikolawna, now in the harbor of Montreal, presents a striking contrast to the modern present-day steel freighter. This ship has a registered tonnage well below 2,000, but carries masts of such a height that it was necessary to step her main-topgallant mast in order that she pass beneath the Quebec bridge. The vessel was originally built in 1873 by R. Steele & Co., of Greenock, Scotland, and on her recent voyage out from Newcastle-on-Tyne made the trip in thirty days.

FAIRBANKS-MORSE

Production Plus Quality

THE craftsman of a generation ago is the skilled operative of today. Intensive wants, competition, invention have begotten intensive methods. Everything has changed—everything except the demand for quality. And today quality must unite with economy if the result is to be successful.

Today Canada demands increased production. More goods, an ever-increasing supply—and quality must be maintained with the increase of quantity. The old craftsman often took years to perform the task that the skilled mechanic now accomplishes in a day.

Machinery has done this and today The Canadian Fairbanks-Morse Co. Limited are making it possible for the artisan to do the work of the master-craftsman at lightning speed. For quality of product, quality of tools is necessary. The workman does the job, but the machine assures mechanical precision—all those details which insure a product satisfactory in its last analysis.

That is why Fairbanks-Morse machine tools should always be specified. There is behind each lathe, grinder, shaper, planer, and so on down to the smallest tool, the dominating spirit of The Canadian Fairbanks-Morse institution, the never-relaxing effort to give 100% quality of produce and service.

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MARINE NEWS FROM EVERY SOURCE

Montreal:—During the month the level of the St. Lawrence has been very low, and on one occasion showed 28 feet 9 inches in the channel, which is within one inch of the lowest mark ever recorded.

Detroit:—The death occurred on Oct. 19th of Capt. John Rourke, at his home in Windsor. He was for many years in charge of the little passenger steamer "City of Chatham" which ran between Detroit and Chatham, and was very well known on the lakes and to the general public. The cause of death was diabetes, and the deceased was 65 years old.

Cleveland:—During the week ending October 16th the coal fleet loaded over 1,000,000 tons, which is the first time the 1,000,000 mark has been reached for some weeks. Shipments for the season up to October 18th were 17,046,737 tons, which is two million less than last season, and about seven millions less than 1918.

London:—In recognition of his services in the salvage work of the war, and particularly in the raising of the "Vindictive," Captain Fred Young of the Liverpool Salvage Association has been made a Knight Commander of the Military Division of the Order of the British Empire. Captain Young has a long and excellent record in salvage work all over the world.

Detroit:—The steamer George W. Perkins downward bound with ore, went ashore at Ballard's Reef in the lower part of the Detroit River, and will have to lighter part of her cargo. She went ashore in a thick fog, and sustained some damage to her bottom, the No. 6 tank being reported leaking. Captain Bailey of the Pittsburgh Steamship Company will have charge of the refloating of the Perkins, and the tug A. C. Harding and lighter Rescue have gone to the scene of the wreck.

Buffalo:—The thick fogs which have been experienced recently, have caused considerable delay to vessels in the vicinity of the port. It has been impossible to move steamers at night even with the aid of tugs, and this condition has prevailed well on into the day on several occasions. Capt. Cowles, of the Cowles Shipbuilding & Towing Co., says that he has never seen fog so dense in all he years he has been in business in the port.

Buffalo:—The grain elevators in Buffalo have been pretty active since the wheat started moving, and are in good shape to handle all that comes along. In the week ending with Thanksgiving Day they unloaded approximately 6,000,000 bushels from lake steamers, and loaded about 3,300 cars for the Eastern seaboard, besides loading about 500,000 bushels in canal boats. The stock on hand at the same date was 4,500,000 bushels.

Duluth:—While shifting at the Hanna coal dock the steamer Labelle sustained some damage to her hull, in a peculiar manner. The end of a railroad iron used as a fender to protect the concrete front of the dock caught on the butt of a plate, and caused a hole seven feet long and three to five inches wide. After puncturing the plate the rail sheared off several frames. The vessel was taken to Superior shipyard for repairs.

Rather Buy Than Build.—Although no statement is being made in advance of the declaration of the successful bids, the Canadian Pacific Ocean Services have put in tenders for some of the German passenger vessels which are being disposed of by the British Government. It is probable that at least one first-class and one second-class boat may be secured. The company prefers to buy rather than to build, because of the high cost of construction to-day, which Sir Thomas Fisher recently commented upon very strongly. The Empress of Canada recently launched on the Clyde, cost, roughly, £1,700,000, as compared with £550,000 for which it could have been constructed before the war.

To Build Tankers.—According to Mr. G. A. Reading, representative of Robt. Reford Co., steamship agents, the keel of a ten-thousand-ton oil tanker will, in a few weeks, be laid on the ways recently vacated by the "Canadian Mariner," at Halifax. If all goes well the Halifax shipyards will contract for the construction of several oil tankers of large tonnage. Mr. Reading added: "The recent launching of the Canadian Mariner marked the fulfillment of the dreams of shipbuilding officials in Nova Scotia. Built entirely of steel by Canadian workmen, it is the largest ship ever launched in the province." As this was the first ship to be built by the Halifax shipyards the launching was naturally viewed with some trepidation by the promoters, and it was with relief that they saw the big vessel slide easily from her stocks.

Toronto.—Two sections of the new floating dry dock which is being built in Montreal for the Russell Shipbuilding Co., of Toronto, have arrived here.

The Whitehall Oil Co., with which Lord Cowdray is closely identified, intends to undertake extensive exploration for oil in the Canadian West early next year. The company has secured the services of a number of experts who have been loaned by the Geological Survey, and surveys are now being made in Western Alberta. Arrangements have been made to have drilling machinery on the ground in the spring, when boreholes will be put down in selected areas. It is rumored that the British Admiralty is associated with the project.

Ask Injunction.—Following the sale of the Cramp Steel Company's plant in Collingwood to the Baldwin's Canadian Steel Corporation Limited, the municipality made a seizure of the plant when it was found that it was the intention of the purchasers to move the equipment to Toronto. The reason for the seizure was the alleged arrears of taxes, which, with the compound interest to date, reaches almost $200,000. The original owners claim that there was an agreement with the municipality whereby the arrears in taxes would not be collected, but this was cancelled following the sale. The Baldwin Corporation claims that before the sale was completed they secured a statement from the town treasurer that there were no arrears of taxes, and also obtained a receipt for the 1919 taxes. Following the seizure an injunction was asked by the company restraining the town officials from seizing the plant, but no answer has been filed in defence.

The Arthur S. Leitch Co., 1,002 Kent Building, Toronto, have recently taken over the agency for the Brown Instrument Company, of Philadelphia, and will handle their complete line of thermometers, recording pressure gauges, pyrometers, draft gauges, and recording tachometers. This will add greatly to the convenience of users of these instruments in Ontario, and should be of interest to those interested in this class of equipment.

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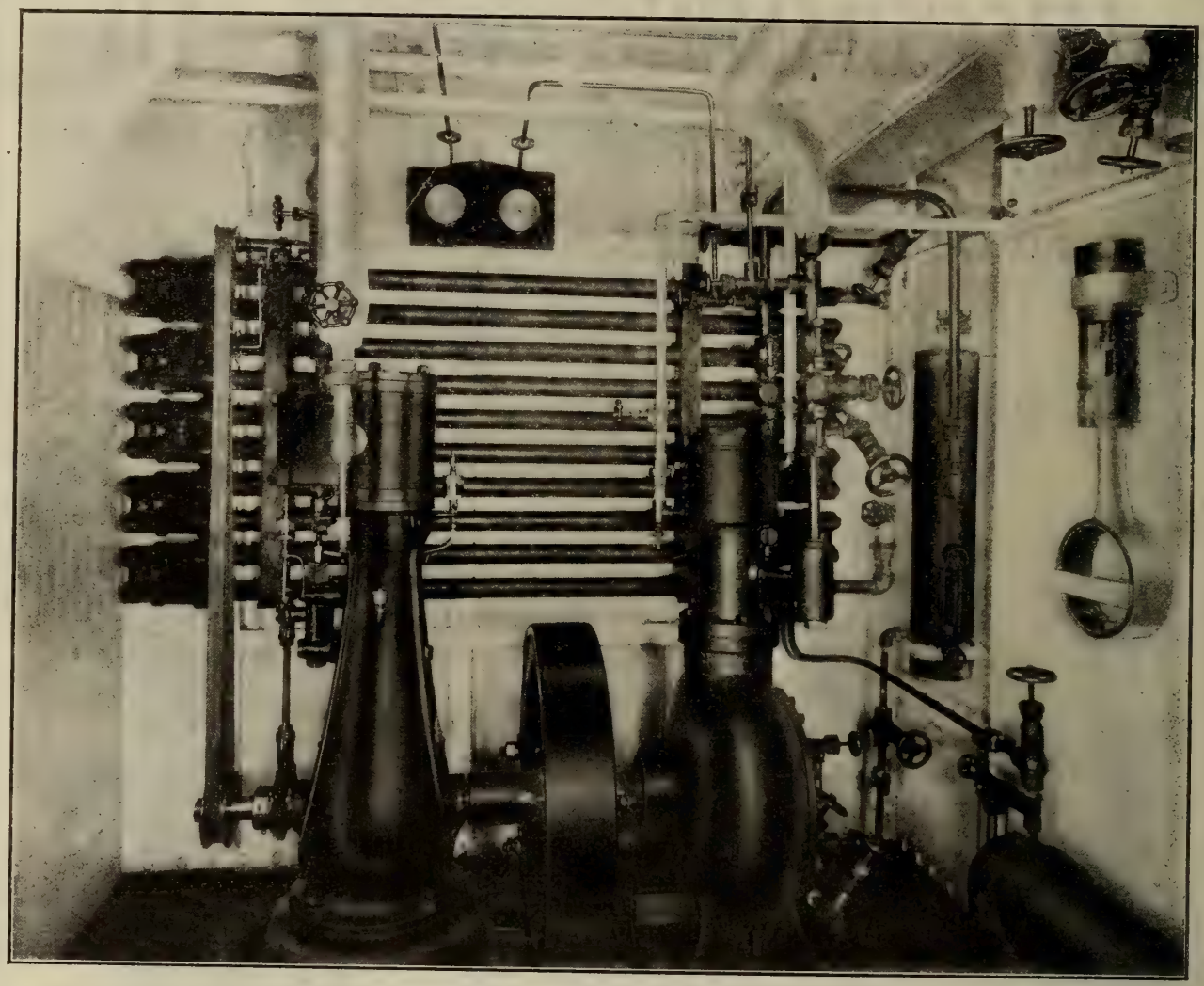

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What others say about them:

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After two years' experience with this machine and several experiences with other high-class machines we are of the opinion that the Brunswick is the most economical machine that we know of, and we do not think you would make a mistake in adopting it."

File No. 6015.

"Speaking of customers being pleased with a job—the Chief told our man that when she sailed he put a ton of ice in the ice box, and when he came back he had a ton and a half. WHAT?"

File No. 643.

"Had we not thought that the Brunswick was the best machine of its kind that we knew of, we certainly should not have added to our equipment. We find them economical in consuming ammonia as well as steam."

File No. 5984.

"I wish to take advantage of the opportunity which this season of the year affords to thank you for the prompt and courteous treatment which all our orders have received. Also to inform you that the two plants installed by you during the past year are giving absolute satisfaction."

File No. 6.

"We arrived in New York without adding any gas to the system. Temperature as low as 10 degrees in inside room and 20 to 30 in outer rooms, temperature of air 80 degrees and water 82 degrees, running only daytime. Everything kept fine."

File No. 2361.

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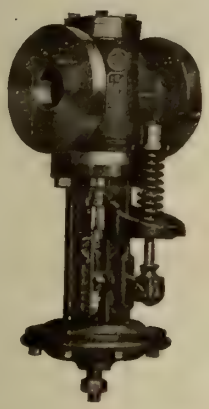
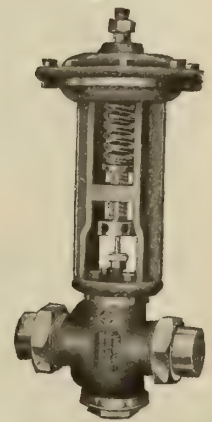


Mason No. 126 Style Marine Reducing Valve



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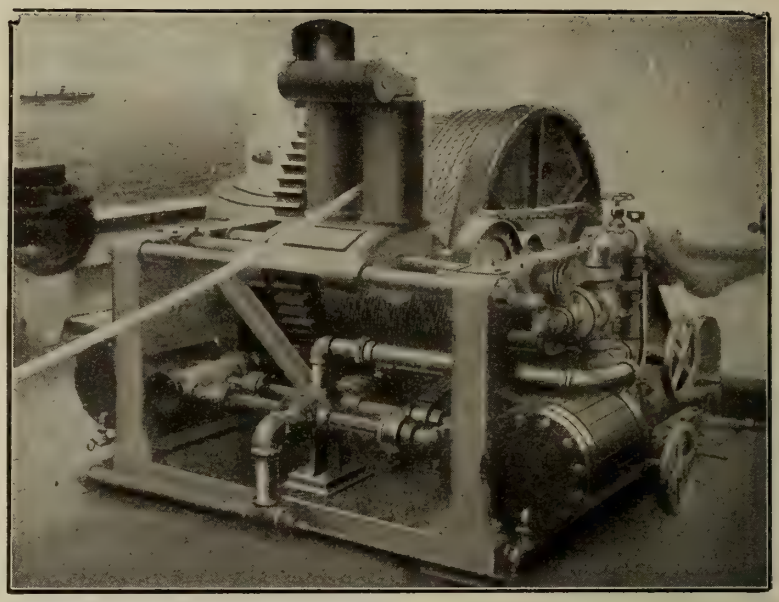
Steam Towing Machine

This towing machine is noted for its strength of construction. Last fall a number of steel barges were cut in half at Collingwood and towed in sections through the canals to Montreal. Two tugs were employed on each half section. The tugs "Keenan" and "Thompson" were employed on one occasion. It was found that the towing line on the "Thompson" was too short; so instead of each tug taking a separate hold on the barge the "Thompson" hitched on the bow of the "Keenan." This method left the strain of both tugs upon the one (Corbet) towing machine instead of two. This fact is surely convincing evidence of the strength and adaptability of the Corbet Steam Towing Machine.



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Probably the best known rod packing on the market. Unequalled for the packing against steam, water, air, ammonia, and other fluids.

Many practical tests by experienced engineers under various conditions have clearly demonstrated that P.P.P. is the most economical rod packing to use. Its long life is remarkable, its ability to create a saving in the fuel bill is well known.

"The Story of Some Friction Test"

is a booklet that should be in the hands of every marine engineer and others who have anything to do with rod packing.

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Used on many of the largest vessels plying the lake and ocean trade for high pressure, super-heated steam, hot water, ammonia, oils and all other kinds of joints requiring packing.

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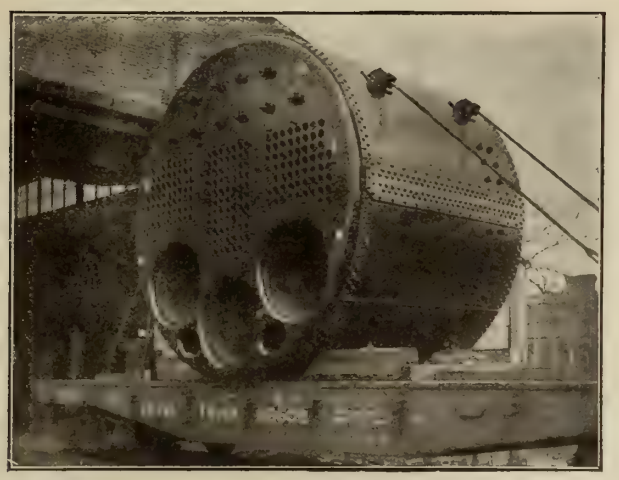

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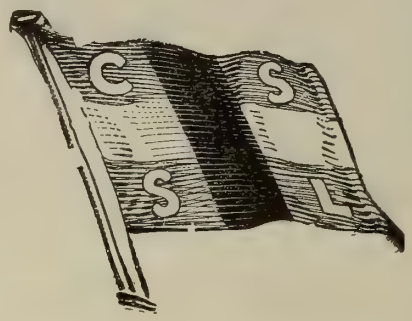

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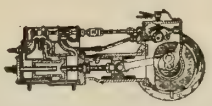

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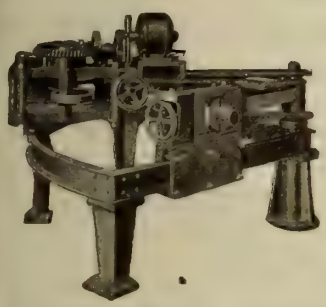

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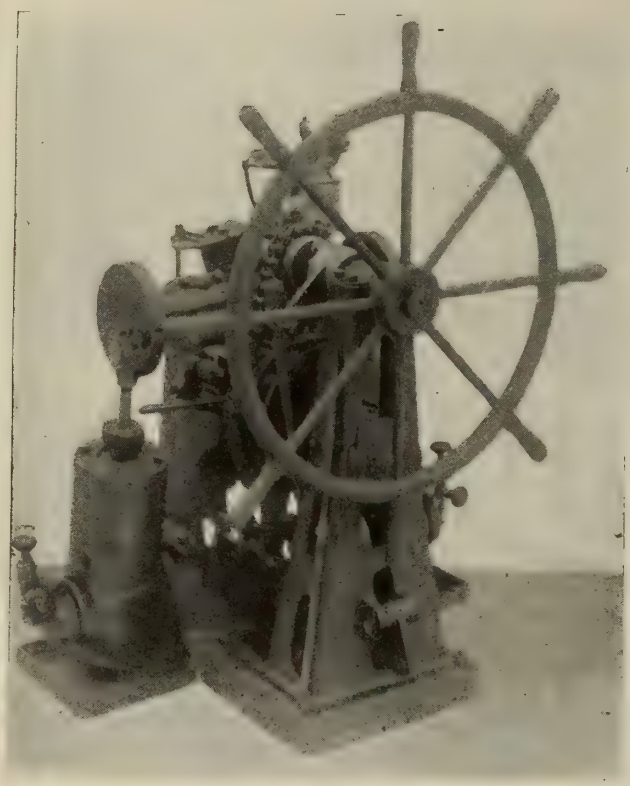

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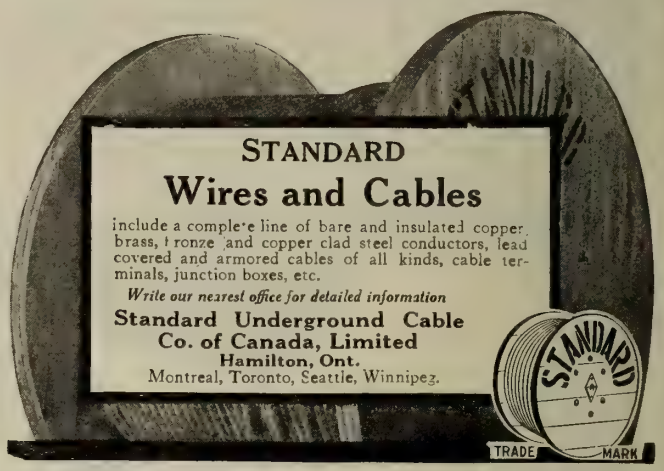
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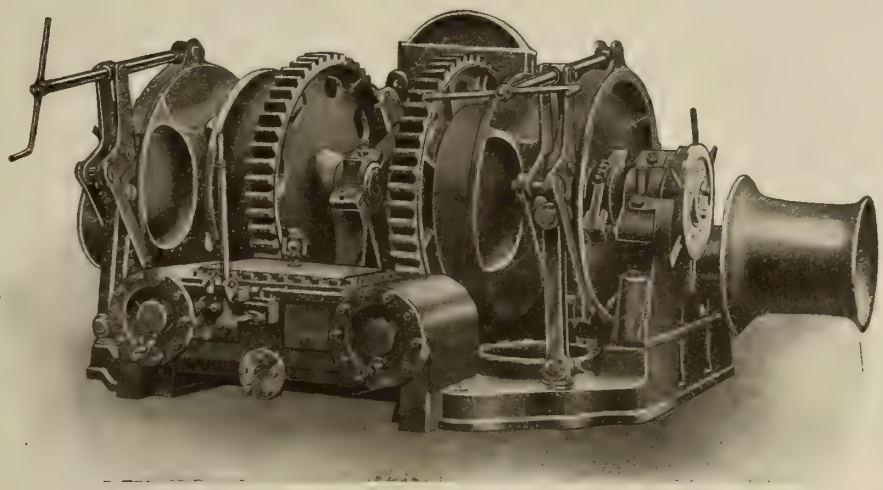

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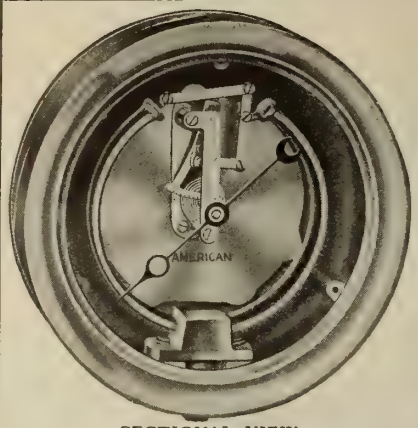

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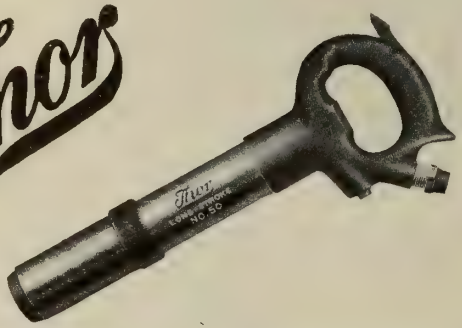

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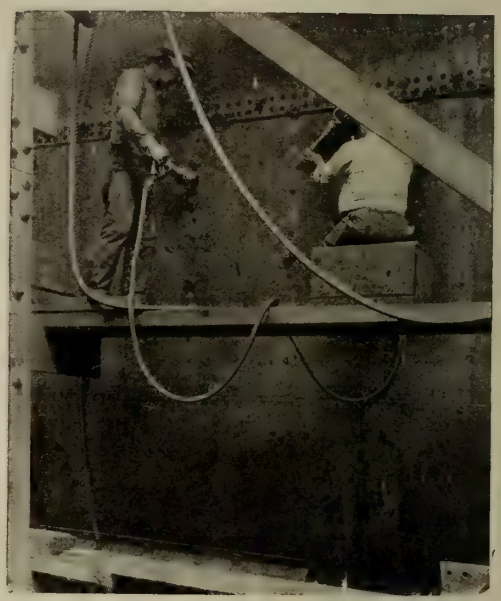

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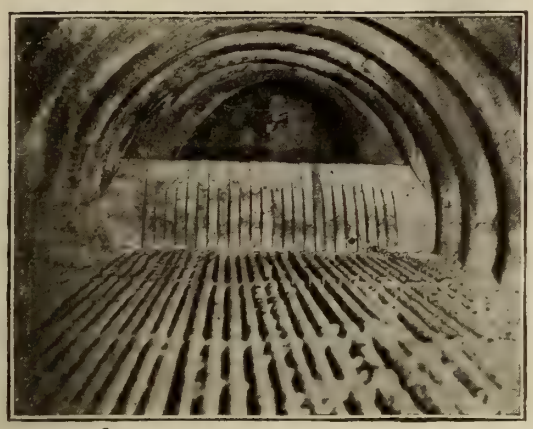

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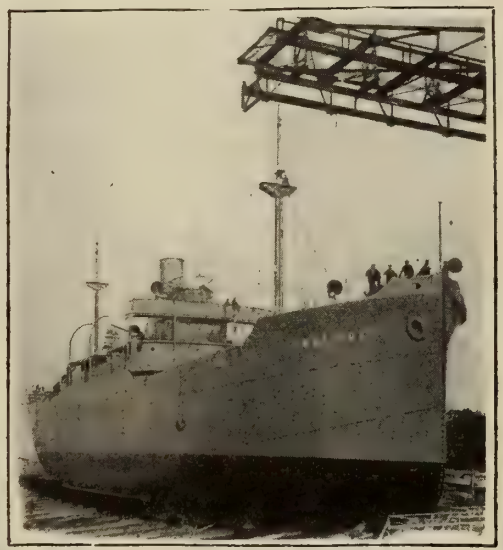

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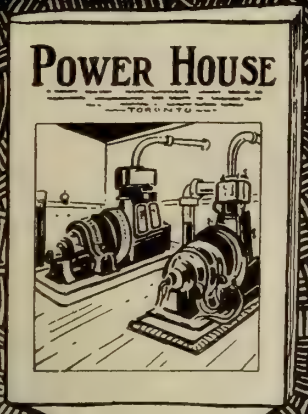

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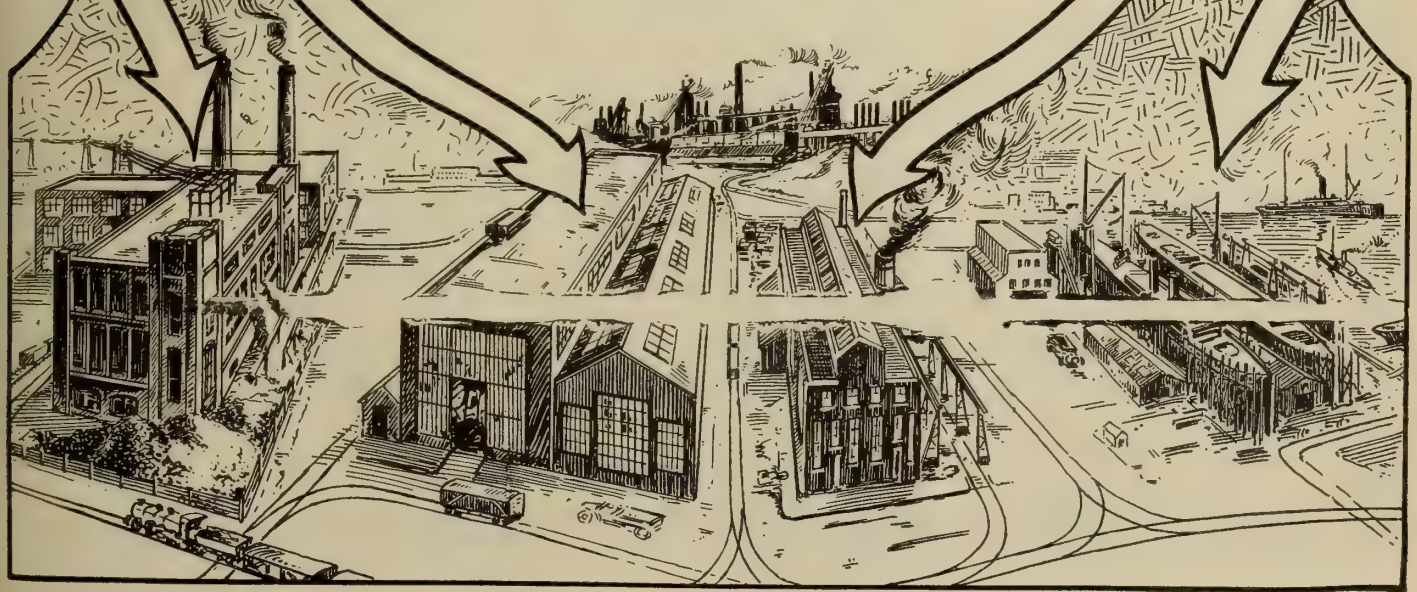

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Waterous Engine Works Co., Brantford, Ont.

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Crane Ltd., Montreal.

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New Burrell-Johnson, Yarmouth, N.S.

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New Burrell-Johnson, Yarmouth, N.S.

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Scaife & Sons Co., Wm. B., Oakmont, Pa.

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Row & Davis Engineers, Inc., New York, N.Y.

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Hopkins & Co., F. H., Montreal, Que.

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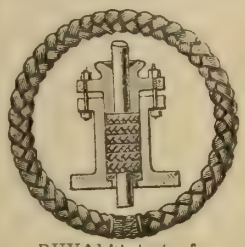

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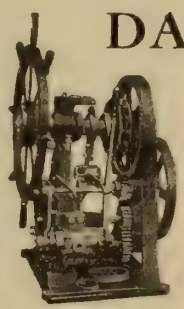

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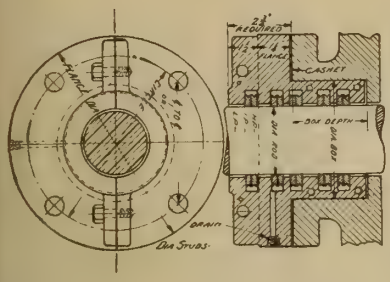

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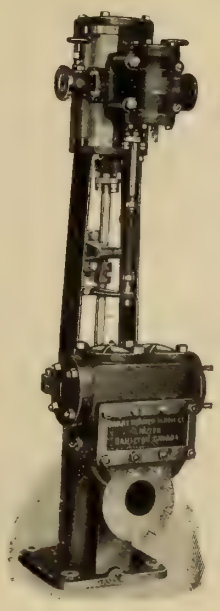

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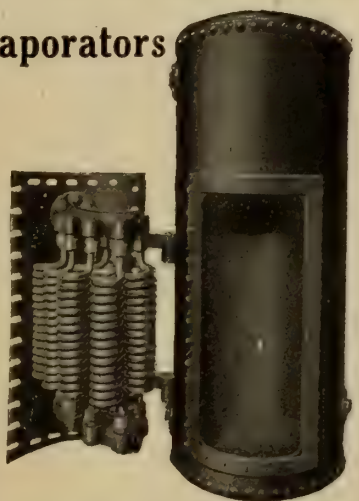

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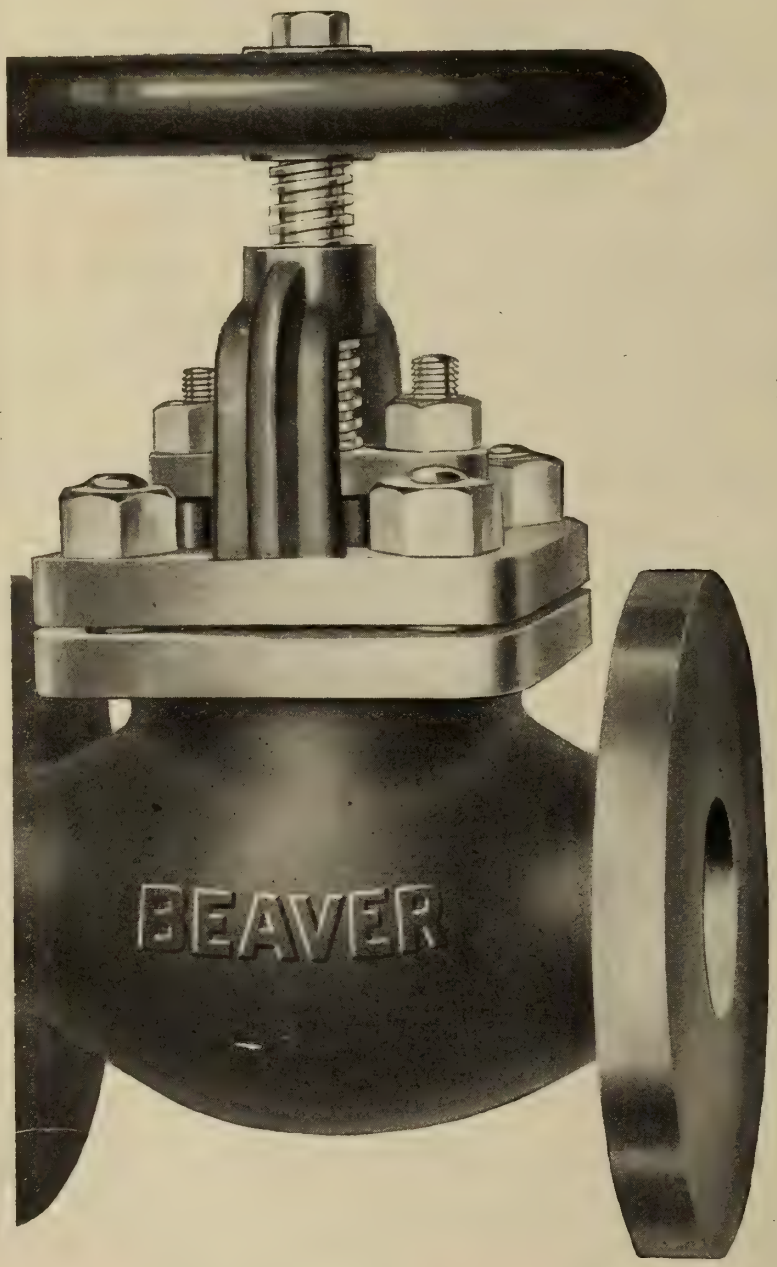

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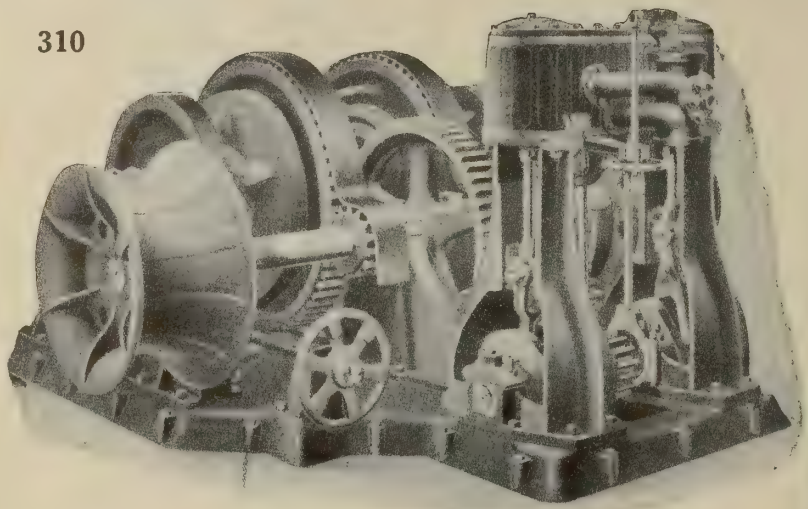

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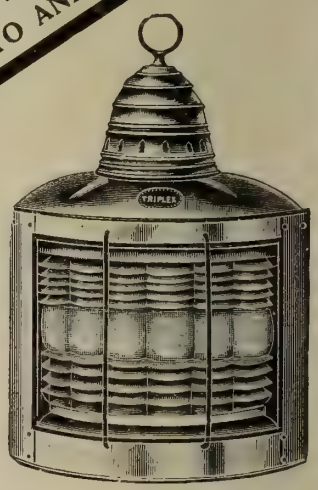

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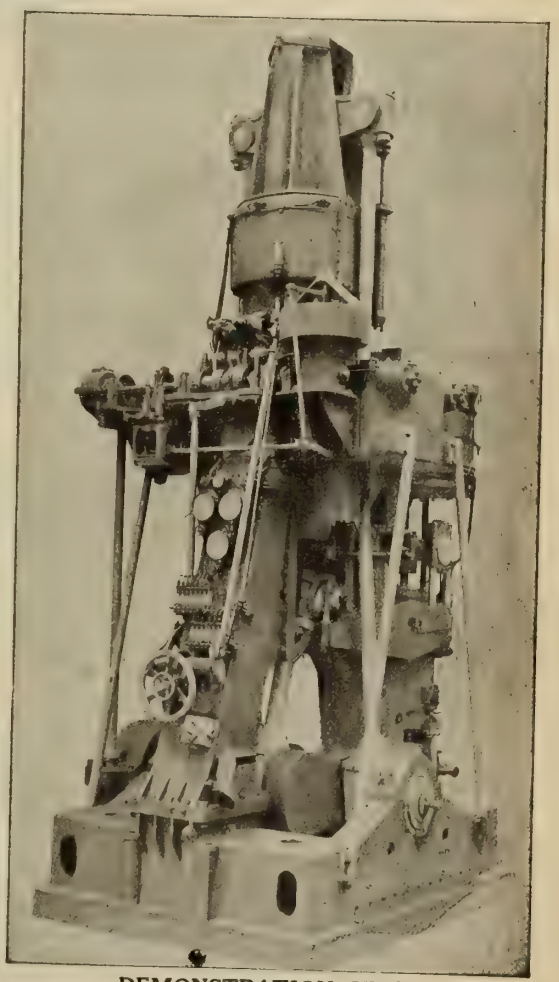

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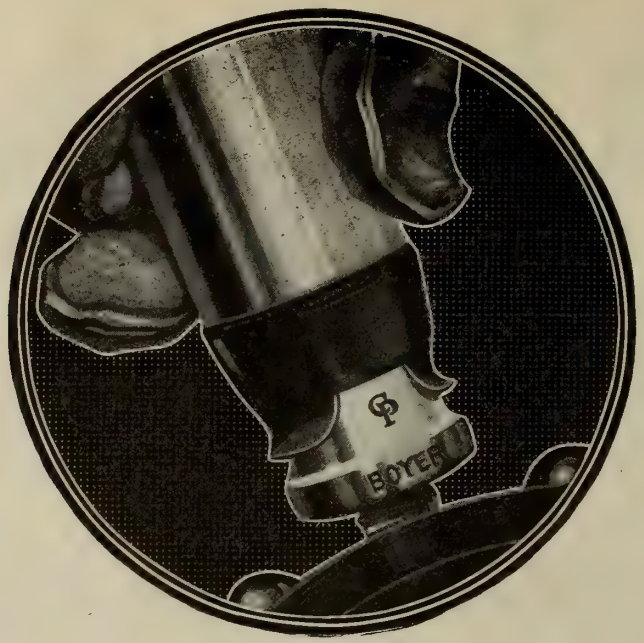

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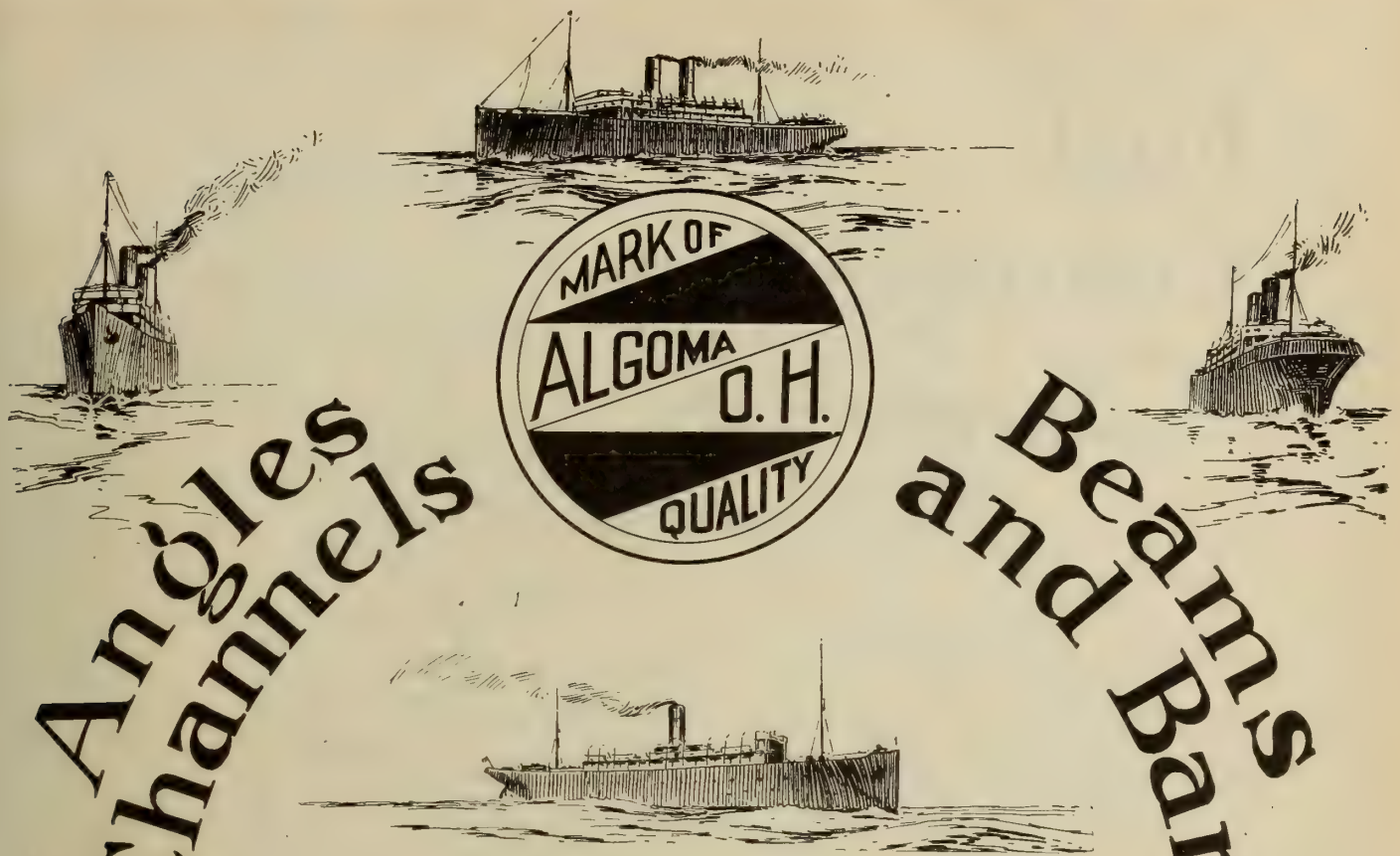

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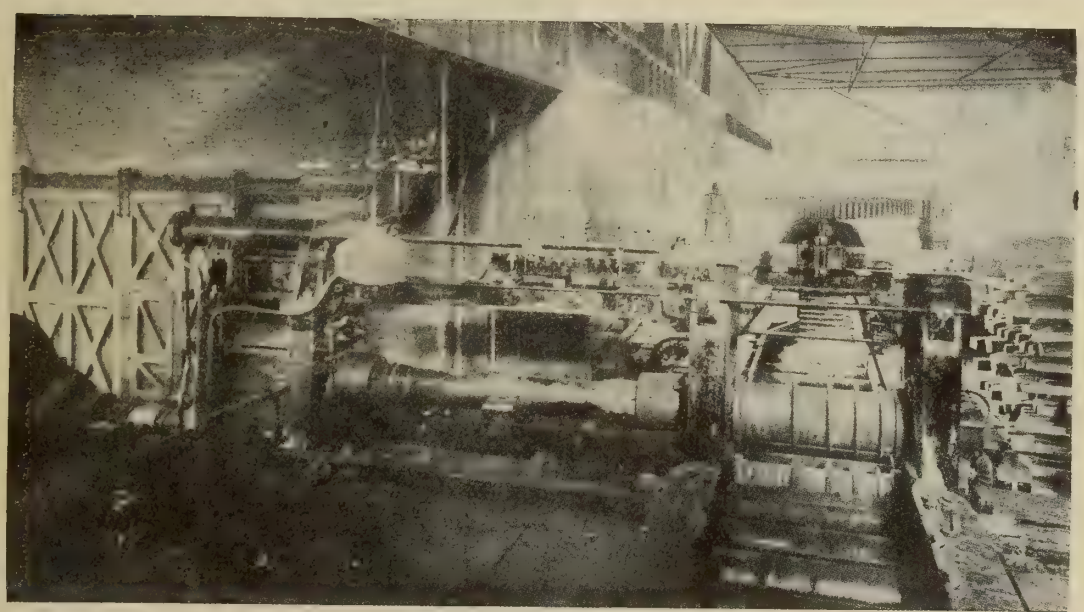

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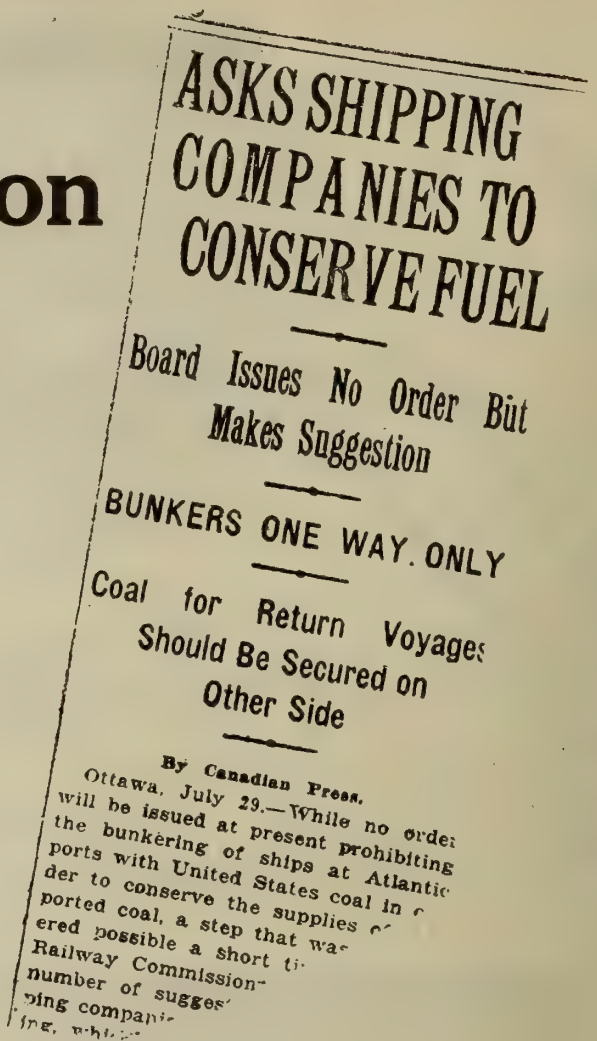

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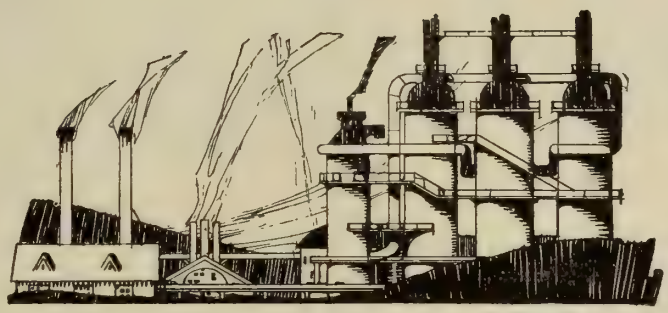

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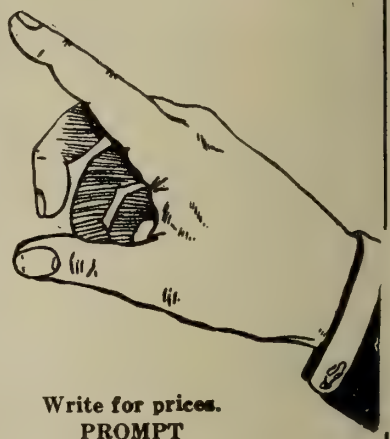

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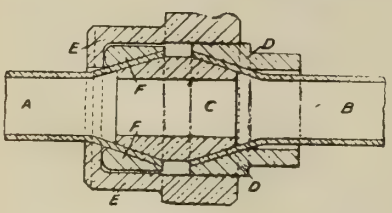

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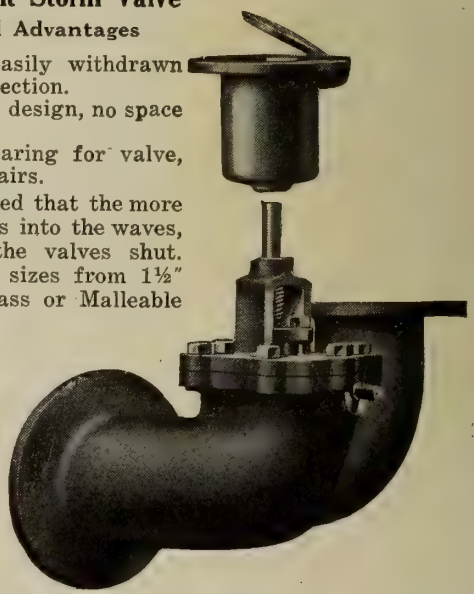

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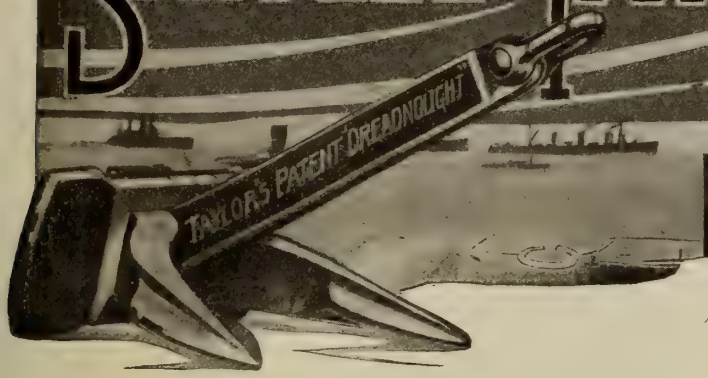

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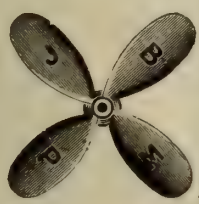

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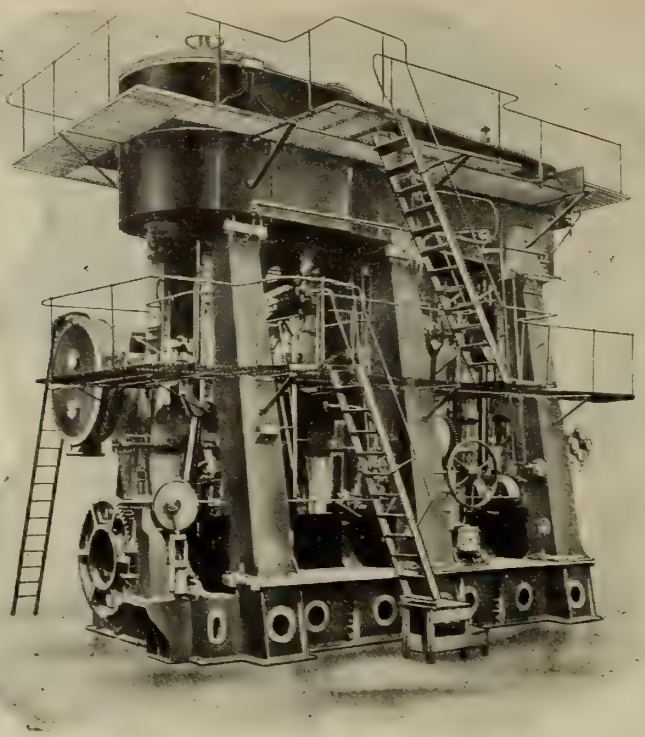

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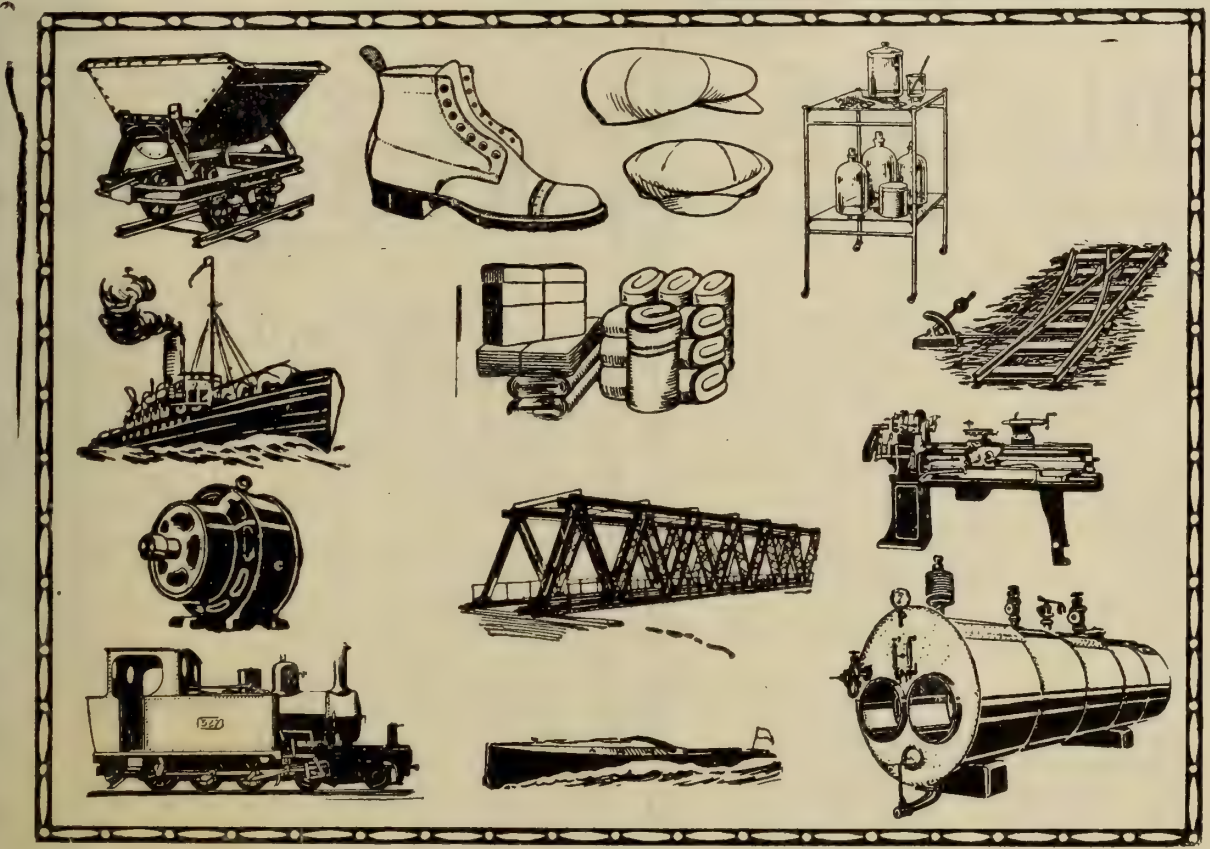

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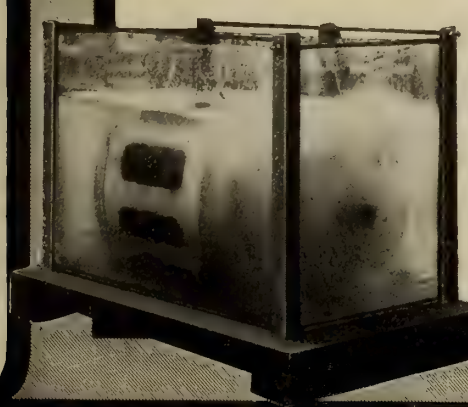

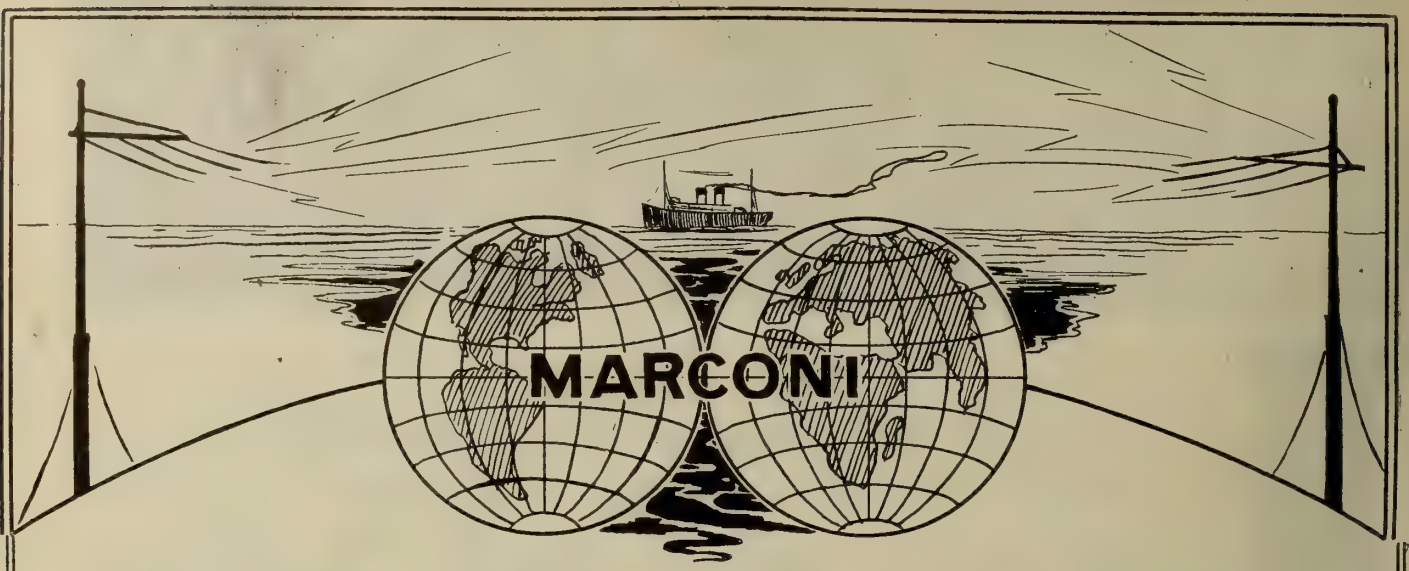

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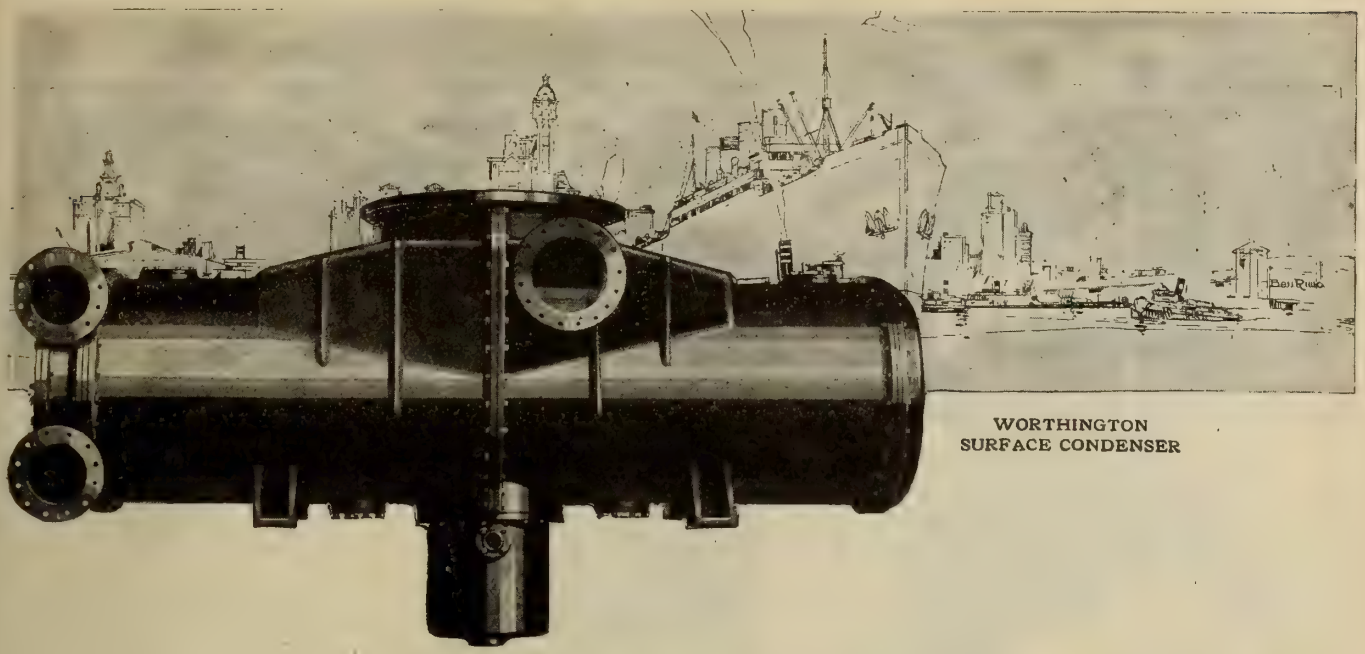

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There is no type or capacity condensing machinery that Worthington does not build; and whether for shipyard or for land service, there is Worthington condensing machinery to meet and satisfy any service requirement.

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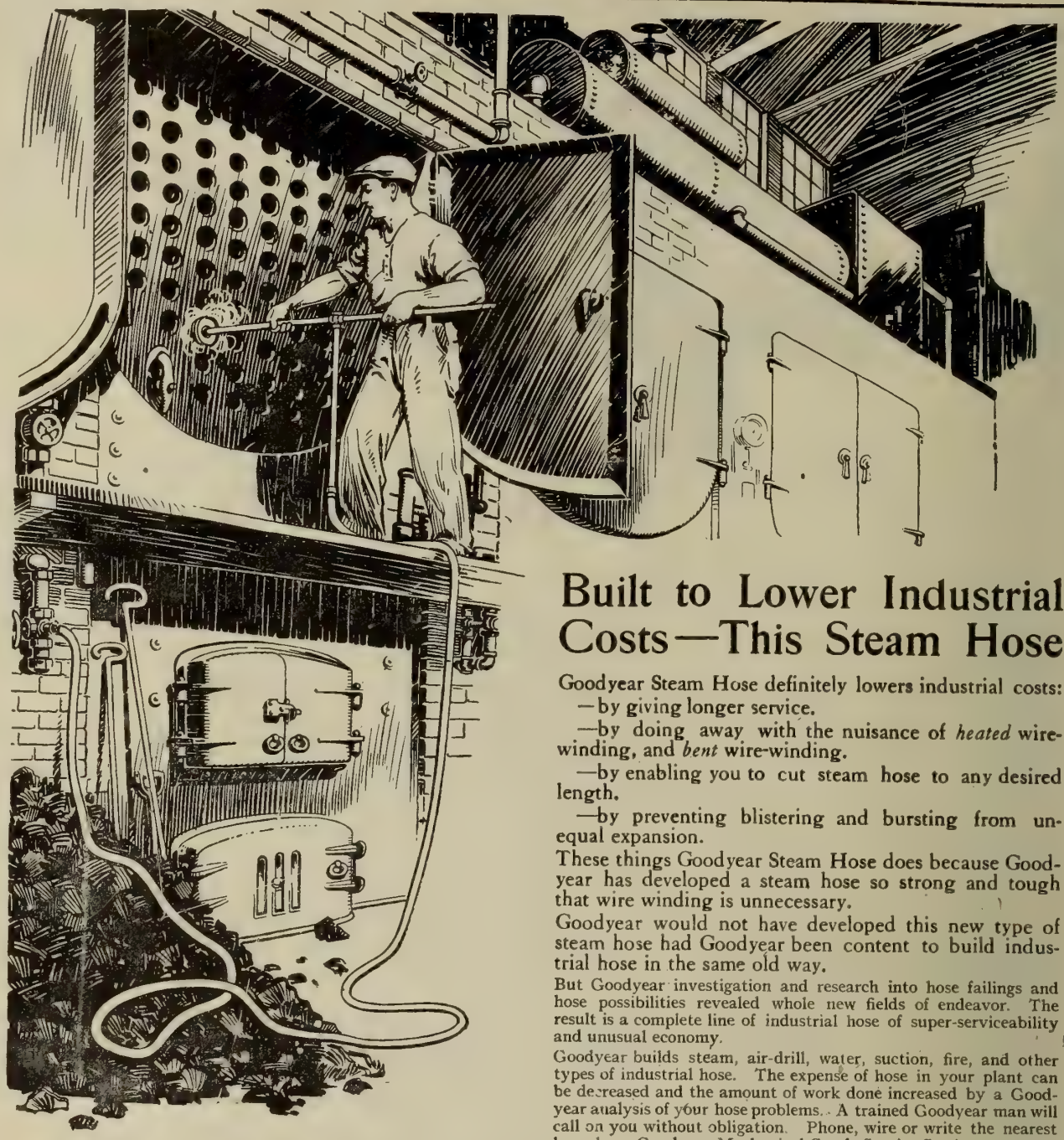

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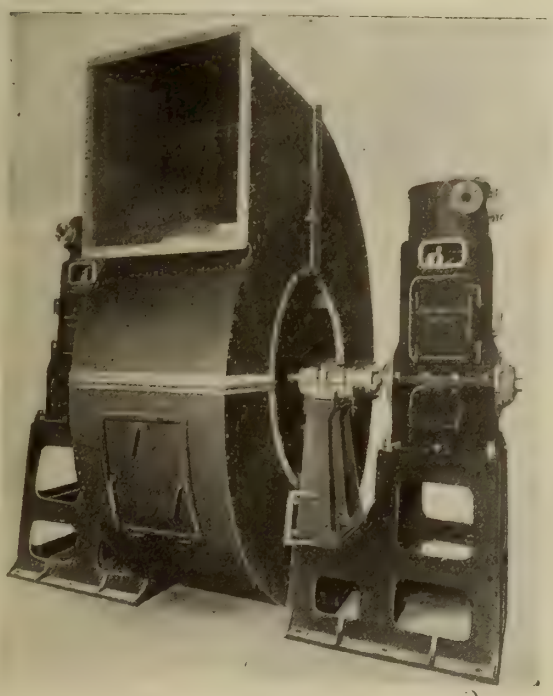

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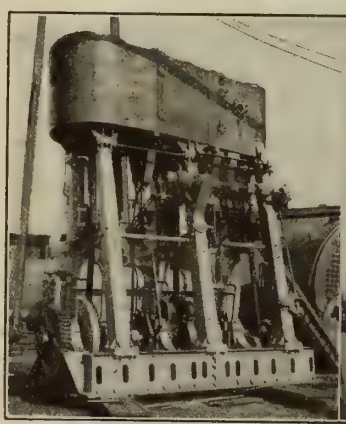
Breadth Moulded 52 ft.

Depth Moulded 28 ft. 9 in.

Gross Tons 6,905



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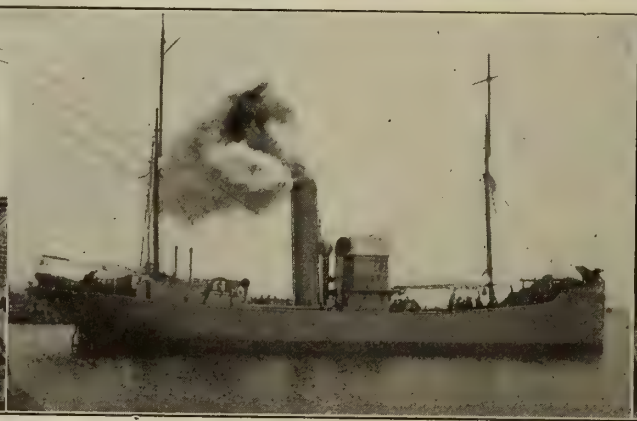

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MARINE ENGINEERING
and
Canadian Merchant Service Guild Review

Vol. X. NOVEMBER, 1920 No. 11

Still and Sulzer Marine Diesel Engines

Comparative Trials of Still and Sulzer Engines Under Actual Working Conditions on Board Ship—Paper Read Before the Institution of Naval Architects

By MR. WILLIAM DENNY

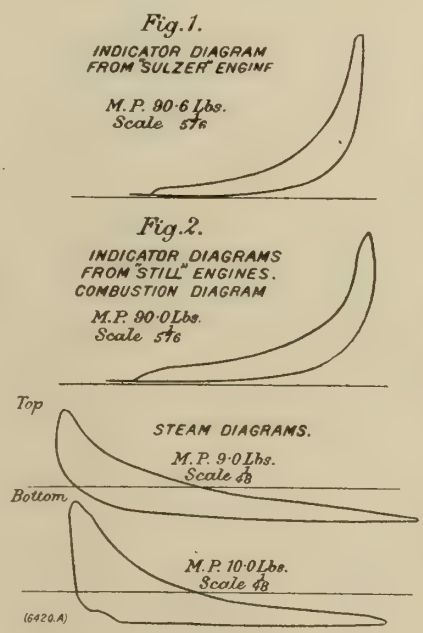
IN the year 1913, Messrs. William Denny and Brothers took out a license from the firm of Sulzer Brothers, Winterthur, for their special type of oil engines. To obtain experience in the manufacture of such engines, they arranged to proceed with small twin-screw engines of about 250 i.h.p., in all, and to build a hull in which these engines would be thoroughly tested—both the hull and the power of the engines arranged for corresponded with a standard type of light draught passenger and cargo steamer, of which a number had been built for service in the rivers of India and Burmah. These vessels are 100 feet long, 23 feet 6 inches beam, and 7 feet 6 inches deep, and have an approximate speed of 10 knots with 250 i.h.p. When war broke out the hull and engines for this experiment were well advanced, but under "control" conditions the work on them was stopped to make way for the pressing requirements of the Government.

For some time before the war the firm had been interested in the "Still" engine; fairly early in the war period it was arranged, with the consent of the Admiralty, that an experimental Still installation, to correspond with the hull already mentioned, should be proceeded with, being twin-screw engines of, in all, 250 i.h.p., or thereby. This arrangement was carried out and the vessel with the Still engine was exhaustively tried.

On the conclusion of the war it was decided to complete the original set of Sulzer engines and fit them to the same hull—the Still installation, so far as necessary, being, of course, removed from the vessel. This experiment also was duly carried out and the results with both types of engines are given later.

In carrying out these comparative trials everything possible was done to ensure that the results in all respects would be reliable—the same oil was used, the same propellers, the same draught, the vessel was run on the mile to check the speed in terms of revolutions, the oil consumption trials were repeated several times, and during each trial were checked at stated time intervals, and it is considered that the results as given may be regarded as reliable.

The Sulzer type of oil engine is well known, and the Still system has been fully described in a paper read by Captain F. E. D. Acland before the Royal Society of Arts on May 26, 1919, but, for the information of those who have not yet read that paper, it may be stated briefly that the Still type of engine is a combination of the steam and of the internal-combustion engine, steam acting on one side of the piston, while oil combustion takes place on the other side, within the same cylinder. A small boiler is part of the installation, from which the



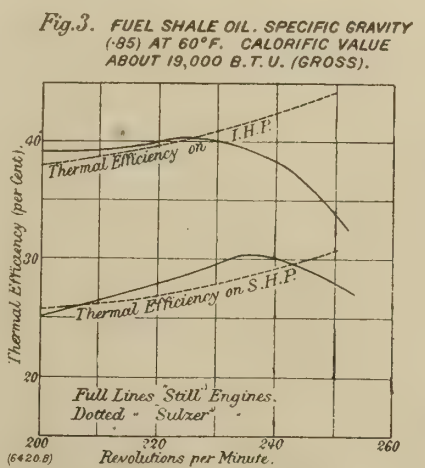
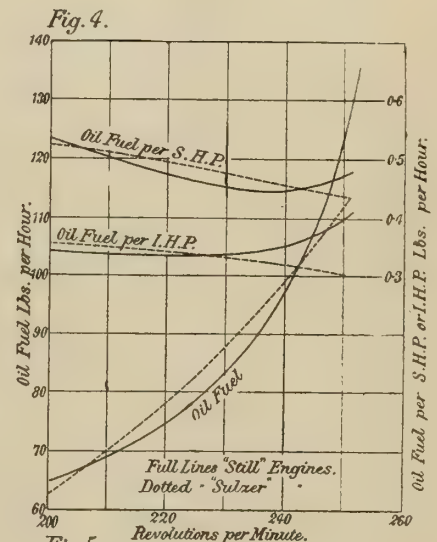
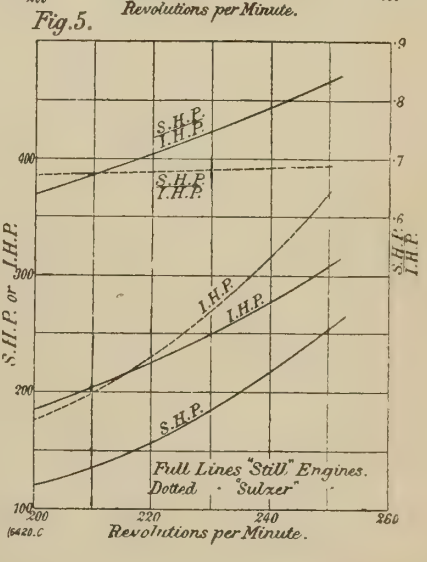


Fig.3. FUEL SHALE OIL. SPECIFIC GRAVITY (·85) AT 60°F. CALORIFIC VALUE ABOUT 19,000 B.T.U. (GROSS).
Thermal Efficiency (per cent.)
Thermal Efficiency on I.H.P.
Thermal Efficiency on S.H.P.
Full Lines "Still" Engines.
Dotted - "Sulzer"
Revolutions per Minute.
(6420.B)





FIGURES 1 TO 5 EXPLAIN THEMSELVES.

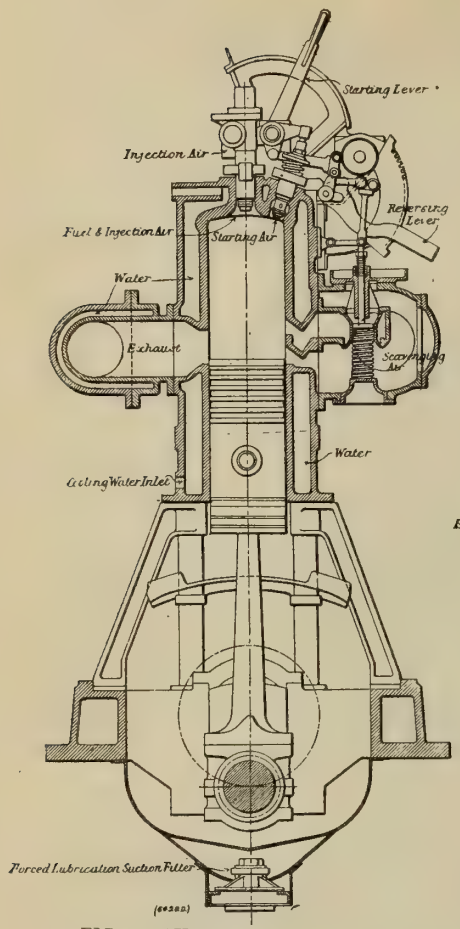


FIG. 6.—SULZER DIESEL ENGINE.

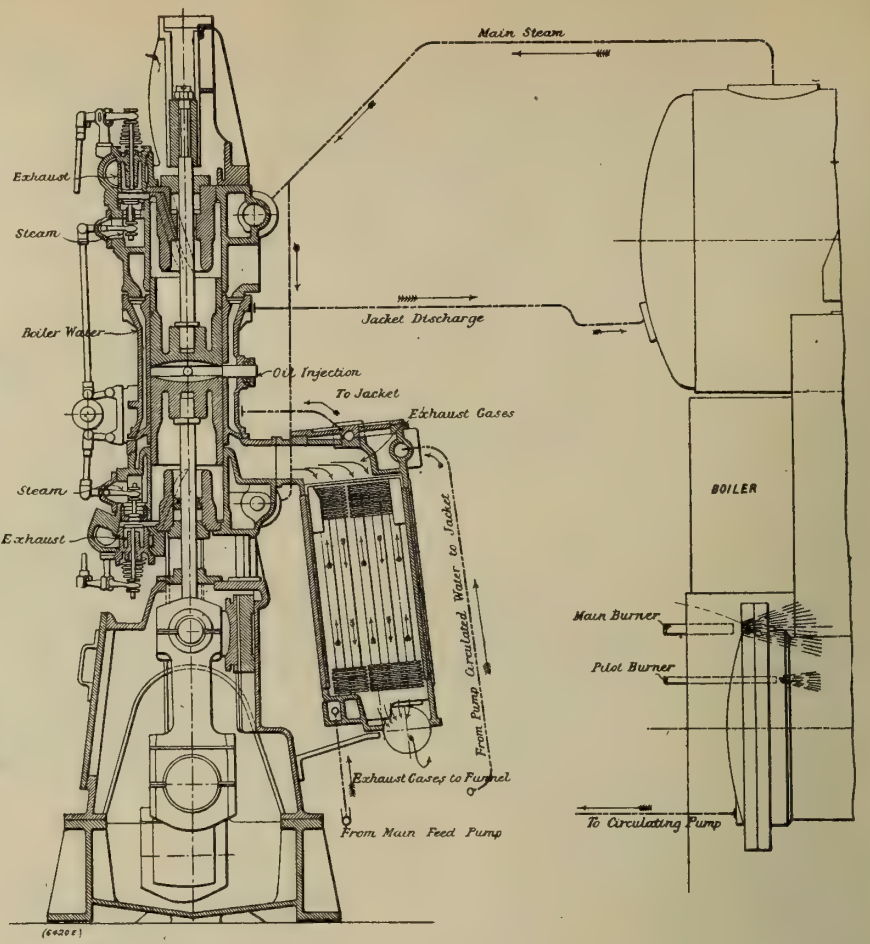


FIG. 7—STILL ENGINE.

steam, generated by burning oil in the boiler in the usual way, is employed as the starting agent for the engine; the boiler also acts as a receiver for the steam derived from the waste heat of the exhaust gases of the internal-combustion part of the engine. The feed water is circulated by a pump drawing from the bottom of the boiler and discharging through the tubes of a generator, which is heated by the exhaust gases of the engine passing round the tubes; thence the water passes to the cylinder jackets of the engine, where it is used as the cooling agent, thus gaining more heat, and thereafter returns to the boiler in the form of steam and water. The steam thus generated is used in the steam end of the cylinder, and adds to the power of the engine as a whole. The exhaust gases pass to the atmosphere on leaving the generator.

When the engine is running normally, i.e., under "waste-heat" conditions, no fuel is burned in the boiler, the steam available being generated solely from the heat in the exhaust gases and from the heat transferred through the cylinder liner to the jacket water. The engine may be run at a considerable overload by augmenting the supply of steam through burning fuel in the boiler. Owing to the high temperature of the cylinder jacket cooling water (i.e., boiler water), the compression pressure in the cylinder necessary for the ignition of the fuel is considerably lower than is the case in ordinary Diesel engine practice. The cycle of the steam portion of the engine is just as in ordinary steam practice, an air and circulating pump, condenser, boiler feed pump, etc., forming part of the installation.*

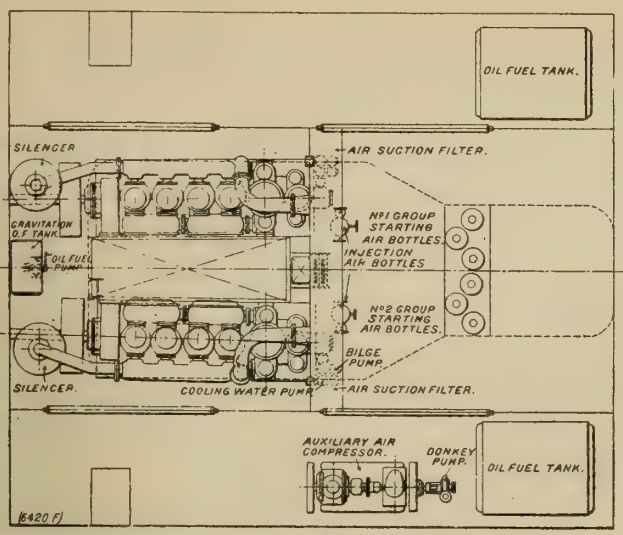
The Sulzer engines in question have cylinders approximately 8½ inches diameter by 13¾ inches stroke—four cylinders to each engine—and are of the two-cycle type. The Still engines have also four cylinders per set, 7¼ inches diameter and 15 inches stroke, fitted with a boiler of the Yarrow type—they are of the opposed piston type and two-cycle.

The Still engines were designed with a view to their powers of manoeuvring being beyond question. It was suggested that a separate high-pressure cylinder might be fitted, the other cylinders being the second unit of the ordinary compound engine. By this means some economy might have been effected, but this complication was decided against. It may be added, while it has nothing to do with the question of relative economy of the engines, that the Still engines were arranged to run astern under steam only. Owing to this the boiler was larger than would be necessary in an engine arranged for astern working with oil also.

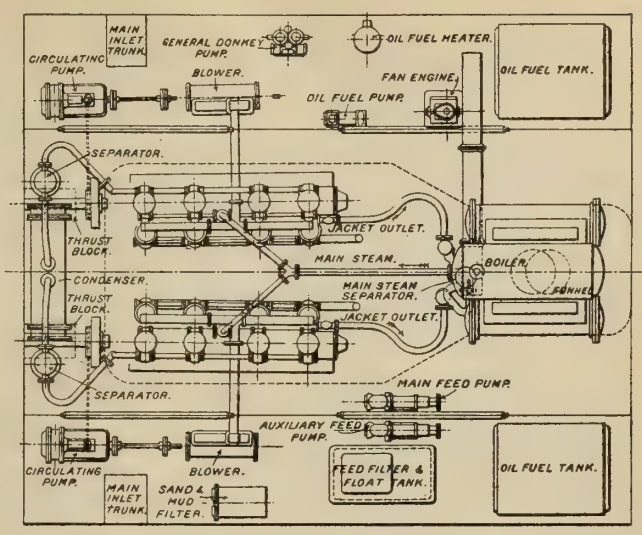
The Sulzer engines on the other hand were made to the patentee's design of 1913. Improvements have been made since then, and it is possible that some of these improvements may tend towards greater economy. It will be observed that the Sulzer engine cylinder capacity is considerably larger than that of the Still engine, which has an effect on the varying relative consumptions at the different numbers of revolutions. In the Still engine the maximum revolutions without overloading and without the use of oil in boiler were about 240.

A representative of each patentee was present at the trials of his own system, and was satisfied that the trials had been carried out in an approved manner. The trials were continued until these representatives were unable to suggest any modifications by which better results might be obtained. The oil used on the trials was shale 0.85 specic gravity. The manoeuvring of both types of engines was quite satisfactory. From ahead to astern the time was about 5 seconds, and in this respect the Still engine had a slight advantage. During the trials, as shown on Fig. 4, the Still engine worked entirely under waste heat conditions, i.e., no oil was burned in the boiler.

It had been suggested that, in the case of the Still engine, oil from the cylinders might find its way to the boiler and have a dangerous effect on it. With this possibility in view, the boiler was frequently examined during the trials with the Still engine, and also at their termination, and there was practically no oil deposit found. On the other hand, the feed



ARRANGEMENT OF MACHINERY FOR THE SULZER DIESEL ENGINE.



ARRANGEMENT OF MACHINERY FOR THE STILL ENGINE.

water filters required frequent attention. The generators remained clean throughout the trials.

The Sulzer engines were entirely constructed by the firm of William Denny and Brothers, but in the manufacture of the Still engines, owing to pressure of work in their own establishment, the assistance and co-operation of Messrs. T. A. Savery and Co., Limited, Birmingham, was arranged for.

In carrying out the trials, the principal aim was to ascertain accurately the oil used in terms of the speed of the vessel, being the point of view most likely to appeal to the shipowner. The following diagrams are appended: Fig. 1, Sulzer engine, oil and steam, indicator cards; Fig. 2, Still engine, oil and steam, indicator cards; Fig. 3, thermal efficiency (approximate); Fig. 4, oil consumption in terms of revolutions (or speed); Fig. 5, indicated horse-power and shaft horse-power in terms of revolutions; Fig. 6, Sulzer engine in section; Fig. 7, Still engine in section, with its boiler; Fig. 8, general arrangement of the Sulzer and Still installations.

The shaft horse-power was taken by torsionmeter. The facilities for fitting this gear were limited, and the results must be regarded as approximate. The thermal efficiency also is only to be regarded as approximate, as the exact calorific value of the fuel oil was not available; it was assumed to be 19,000 British thermal units. The total weight of the Sulzer installation is 25 tons, and of the Still installation, with its special accessories and boiler, 29 tons; but, as previously stated, the boiler was larger than would have been necessary if the engines had been designed to work astern under oil.

*As the experimental engines in question were started, and manoeuvred astern, under cteam, and, as in this case, the solid oil injection principle was adopted, neither storage of compressed air nor compressor was necessary or provided.

H. B. Smith, formerly president of the Northern Navigation Company, has been appointed managing director of shipyards for the Canada Steamship Lines.

AGAIN URGING HELP FOR BUILDERS

Canadian Vickers Official Brings the Matter Up Following a Launching

The Canadian Commander, 8,350 tons deadweight, the eleventh vessel launched by the Canadian Vickers, Ltd., at Montreal, for the Canadian Government Merchant Marine, was successfully launched and christened by Mrs. C. C. Ballantyne, wife of the Canadian Minister of Marine.

Sir Frederick Orr-Lewis, of the Canadian Vickers, speaking after the launching, urged the desirability of aiding the Canadian shipbuilding industry by means of a subsidy from the government. He pointed out that conditions were far from rosy at the present.

Hon. C. C. Ballantyne, Minister of Marine, said he would bring the matter of a subsidy to the attention of his colleagues in the government. He stated that the Canadian merchant marine now had 40 vessels trading to all parts of the world and would have the full total of 63 in operation next season. The company was run at a profit last year and would be again this year.

The Superheater Company of Canada, Transportation Building, Montreal, and with works at Sherbrooke, Que., has been incorporated to manufacture steam superheaters for all classes of service. The company is giving special attention to locomotive, marine and stationary equipment and have Canadian rights for manufacturing the "Electo" Superheater. Equipment for stationary power plants is designed to suit each installation and this is particularly true in case of stationary power plants, the superheaters being applicable to any type of water or fire tube boilers. Superheaters of the type manufactured by this company are now in general service in locomotive and marine and stationary plants throughout the world. The company uses a patented form of bending the tubing in its superheater which is termed a forged return bend which is formed from the metal of the pipes themselves without any autogeneous welding. This is also being largely sought after for use in various styles of pipe coils and condensers.

AIR BOOSTER FOR CENTRIFUGAL PUMPS

Two single-stage centrifugal pumps were sufficient to keep down the water at the Algoma mine, Ironton, Minn., when the flow increased owing to the cessation of pumping at an adjoining property, says H. H. Hunner in Engineering and Mining Journal. One pump was driven by a 75-h.p. motor at 1750 r.p.m., rated at 1290 gal. per min. against a 165-ft. head, and was pumping at approximately this head. The second pump was direct-connected to a 100-h.p. motor making 1750 r.p.m., and was rated at 1500 gal. per min., with a 170-ft. head. Suction and discharge for both pumps were 6-in. diameter pipes.

Elbows on the discharge pipes were tapped for 1-in. pipe connections about five feet from the pumps, connected to an air line, and the valves were slightly opened on a 90-ft. air pressure. The added pressure increased the capacity of the pumps by 200 or 300 gal., which was sufficient to take care of the increased flow of water. The small amount of air used was not noticeable on the air line.

Still Hope For Coal.—In spite of adverse reports from Government investigators, the Shelburne coal seekers are not discouraged but are keeping right on with the search. A double shift is now at work sinking a shaft on the Lyon farm and as soon as the rock is reached a diamond drill will be put at work. A second diamond drill is being secured, which will be placed on another farm in the prospect area. The promoters are quite sanguine of finding coal in paying quantities; the rest of the Shelburne people have adopted a "wait and see" attitude.

LLOYD'S REGISTER SHIPBUILDING RETURNS

For the Quarter ended September 30, 1920

THE returns of the world's output of shipbuilding for the quarter ended Sept. 30, 1920, compiled by Lloyd's Register of Shipping, have been published and contain as usual many features of interest. It should be noted that warships are not included in these returns, and that complete totals for Germany not being available, no figures are shown for that country.

The merchant tonnage building in the United Kingdom at the end of September, viz., 3,731,098 tons, shows an increase of 153,000 tons as compared with June, 1920, and is 914,000 tons more than the work in hand 12 months ago.

The largest increase has taken place on the Clyde, where there are now 1,327,593 tons under construction.

The total "commenced" during the quarter amounts to 593,821 tons, and includes many large vessels. There are now building 229 vessels of 6,000 tons and upwards, as compared with 151 at the end of September, 1919. The vessels of 10,000 tons and upwards amount to 64.

The output during the quarter shows a decrease of about 40,000 tons as compared with that of the previous quarter.

The total merchant tonnage building abroad—3,834,073 tons—is about 300,000 tons lower than the total building at the end of June; this is due to the large decrease in the tonnage building in the United States—334,000 tons less than at the end of June.

An enormous decrease has taken place in the tonnage under construction in the United States during the last 18 months. At the end of March, 1919, 4,185,523 tons were actually building in that country, which total by the end of September, 1920, has been reduced by 58 per cent., while in the United Kingdom during the same period the figures have increased from 2,524,845 tons to the present record total of 3,731,098 tons, an increase of over 65 per cent.

The figures for France are about 27,000 tons, and those for Holland 24,000 tons higher than at the end of June, while in Canada there is a decrease of about 39,000 tons.

The world's total—7,565,171 tons—is about 156,000 tons lower than the figures for June, and 483,000 tons lower than the "record" figures reached at the end of September, 1919.

The tonnage of vessels actually building under the supervision of the Society's surveyors, and intended to be classed with Lloyd's Register, amounts to 5,019,112 tons, viz., 2,947,004 tons in the United Kingdom, and 2,072,108 tons abroad.

The following figures showing the merchant tonnage building in the world at the end of June, 1914, may be of interest for comparison with the present totals: Building in the United Kingdom, 1,722,124 tons; building abroad, 1,440,766 tons; total for the world, 3,162,890 tons, of which 1,865,337 tons were building under the supervision of Lloyd's Register.

It will be noticed that as compared with the present totals the United Kingdom tonnage is 2,008,974 tons higher, the tonnage building abroad shows an increase of 2,393,307 tons, and the total tonnage building under the supervision of Lloyd's Register has increased by 169 per cent.

MERCHANT VESSELS UNDER CONSTRUCTION.

The Returns compiled by "Lloyd's Register of Shipping," which only take into account vessels of 100 tons gross and upwards, the construction of which has actually been commenced, show that there were **961 merchant vessels of 3,731,098 tons gross** under construction in the United Kingdom at the close of the quarter ended September 30, 1920. The particulars of the vessels in question are as follows, similar details being given for the preceding quarter, for the purpose of comparison:—

Description	Sept. 30, 1920 No.	Gross Tns.	June 30, 1920 No.	Gross Tns.
Steam—				
Steel	912	3,715,653	888	3,563,251
Ferro-Concrete	5	2,354	3	860
Wood and Composite	4	2,129	4	1,799
Total	921	3,720,126	895	3,565,910
Sail—				
Steel	38	10,620	41	9,469
Ferro-Concrete	...	.....	3	2,174
Wood and Composite	2	342	2	600
Total	40	10,962	46	12,243
Total Steam and Sail	961	3,731,098	941	3,578,153

MERCHANT VESSELS UNDER CONSTRUCTION IN THE WORLD

The tonnage now under construction in the United Kingdom is about 153,000 tons more than that which was in hand at the end of last quarter, and about 914,000 tons more than the tonnage building twelve months ago.

The September figures include 32 ocean-going vessels, with a total tonnage of 232,758 tons, intended to carry oil in bulk.

Of the merchant vessels being built in the United Kingdom at the end of September, 738, of 2,947,004 tons, are under the inspection of the Surveyors of Lloyd's Register with a view to classification by this Society.

Where Building	Steam No.	Steam Gross Tons	Sail No.	Sail Gross Tons
United Kingdom	921	3,720,136	40	10,962
Other Countries	1,038	3,779,336	106	54,737
Total for the World	1,959	7,499,472	146	65,699

SIZE OF VESSELS UNDER CONSTRUCTION.

The following table shows the vessels under construction in the United Kingdom, classified according to gross tonnage:—

Gross Tonnage	Steam	Sail
100 and under 500 tons	158	34
500 and under 1,000 tons	116	5
1,000 and under 2,000 tons	93	1
2,000 and under 3,000 tons	87	..
3,000 and under 4,000 tons	97	..
4,000 and under 5,000 tons	55	..
5,000 and under 6,000 tons	86	..
6,000 and under 8,000 tons	101	..
8,000 and under 10,000 tons	64	..
10,000 and under 12,000 tons	7	..
12,000 and under 15,000 tons	32	..
15,000 and under 20,000 tons	21	..
20,000 and under 25,000 tons	4	..
25,000 and under 30,000 tons	...	..
30,000 and under 40,000 tons	...	..
40,000 tons and above	...	..
Total	921	40

WORK IN HAND IN PRINCIPAL DISTRICTS.

The following table gives the total figures for vessels now under construction in the principal shipbuilding districts of the country, as compared with those for the last quarter. Each district, of course, includes places in the neighbourhood of the port after which it is named.

District		Sept. 30, 1920 No.	Sept. 30, 1920 Gross Tonnage	June 30, 1920 No.	June 30, 1920 Gross Tonnage
Aberdeen	Steam	21	22,158	21	19,743
	Sail	..	.....	..	.....
Total		21	22,158	21	19,743
Barrow, Maryport and Workington	Steam	16	133,389	14	131,510
	Sail	..	.....	..	.....
Total		16	133,389	14	131,510
Belfast	Steam	50	351,490	47	337,070
	Sail	3	1,240	2	1,000
Total		53	352,730	49	338,070
Clyde—Glasgow	Steam	180	929,696	174	868,653
	Sail	19	4,211	25	5,694
Total		199	943,907	199	874,347
Greenock	Steam	73	383,686	75	386,430
	Sail	..	.....	..	.....
Total		73	383,686	75	386,430
Dublin	Steam	10	13,525	10	13,225
	Sail	..	.....	..	.....
Total		10	13,525	10	13,225
Dundee	Steam	26	68,250	21	62,380
	Sail	..	.....	..	.....
Total		26	68,250	21	62,380
Hartlepool	Steam	23	107,640	21	98,880
	Sail	..	.....	..	.....
Total		23	107,640	21	98,880
Hull	Steam	56	74,152	61	70,499
	Sail	..	.....	..	.....
Total		56	74,152	61	70,499

Leith	Steam..	27	62,188	27	65,548
	Sail....	..	.....	..	.....
Total	.....	27	62,188	27	65,548
Liverpool	Steam..	70	144,840	67	118,742
	Sail....	..	.....	2	1,494
Total	.....	70	144,840	69	120,236
Londonderry	Steam..	4	28,000	4	28,000
	Sail....	..	.....	..	.....
Total	.....	4	28,000	4	28,000
Middleboro', Stockton and Whitby	Steam..	56	256,503	55	248,480
	Sail....	..	.....	1	680
Total	.....	56	256,503	56	249,160
Newcastle	Steam..	127	658,056	129	650,169
	Sail....	1	2,670	..	.....
Total	.....	128	660,726	129	650,169
Newport, Mon.	Steam..	8	38,146	9	41,274
	Sail....	2	224	..	.....
Total	.....	10	38,370	9	41,274
Southampton	Steam..	40	64,926	30	51,451
	Sail....	4	600	4	600
Total	.....	44	65,526	34	52,051
Sunderland	Steam..	68	322,098	70	329,503
	Sail....	..	.....	..	.....
Total	.....	68	322,098	70	329,503

OTHER DETAILS

The following details concerning the shipbuilding work of the United Kingdom during the past three months may be added:—

During Quarter ended Sept. 30, 1920	Steam No.	Steam Gross Tons	Sail No.	Sail Gross Tons
Vessels commenced	162	591,605	8	2,216
Vessels launched	139	478,631	5	4,426

MERCHANT VESSELS UNDER CONSTRUCTION ABROAD.

Countries	Steamers and Motor Vessels Steel No.	Steel Gross Tons	Wood No.	Wood Gross Tons	Sailing Vessels Steel No.	Steel Gross Tons	Wood No.	Wood Gross Tons	Total No.	Total Gross Tons
America—										
United States — Atlantic Coast	195	1,229,017	2	1,500	10	4,354	6	6,000		
United States — Gulf Ports	27	141,553	5	8,560	..	....	3	5,400		
United States — Pacific Coast	49	331,150	5	8,450	..	....	1	2,500	312	1,772,193
United States — Great Lakes	9	33,709	..	....	..	....	..	....		
British Dominions—										
Canada — Great Lakes	10	23,848	..	....	..	....	..	....		
Canada — Coast	36	134,780	3	1,057	..	....	15	10,940	89	213,894
Other Dominions	15	37,580	4	1,454	..	....	6	4,235		
Belgium	9	27,970	..	....	..	....	..	....	9	27,970
Brazil	3	660	1	1,598	..	....	..	....	4	2,258
China	12	44,550	5	7,294	..	....	..	....	17	51,844
Denmark	59	114,943	3	1,120	..	....	..	....	62	116,063
France	79	289,936	1	200	..	....	9	2,472	89	292,608
Germany	...	.....	..	....	..	....	..	....	....	.....
Greece	1	900	1	600	..	....	..	....	2	1,500
Holland	163	422,635	..	....	2	765	..	....	165	423,400
Italy (including Trieste)	66	332,363	47	20,014	1	350	42	12,586	156	365,313
Japan	72	262,407	..	....	..	....	..	....	72	262,407
Norway	53	88,673	9	2,121	..	....	..	....	62	90,794
Portugal	...	.....	..	....	..	....	..	....	4	2,590
Spain	29	87,640	2	....	..	....	4	2,590	32	89,390
Sweden	57	117,335	6	2,119	2	1,300	4	1,095	69	121,849
Total	944	*3,721,649	94	57,687	15	6,769	91	47,968	1,144	3,834,073

*Including 11 ferro-concrete vessels of 24,069 tons.

The tonnage being built in the world at the end of September under the inspection of the surveyors of Lloyd's Register, excluding vessels the construction of which has not actually been commenced and excluding all vessels of less than 100 tons, amount to 5,019,112 tons.

THE "CANADIAN ROVER."

On Saturday, October 19th, The Collingwood Shipbuilding Company, Limited, launched the Steamer "Canadian Rover," the seventh vessel which they have built for the Canadian Government's Merchant Marine.

The vessel is of the 'tween deck type of about 3,900 tons deadweight and is intended principally for trade between Canada and the West Indies.

The principal dimensions are: Length, 251 ft.; breadth, 43 ft. 6 in.; depth, 26 ft.

The vessel is propelled by triple expansion engine, having cylinders 18, 30 and 50 in. x 36-in. stroke, and steam is supplied by two Scotch boilers 4 feet diameter x 10 ft. 9 in. long, 180 lbs. working pressure, Howden's forced draught.

Particular attention has been paid to the cargo handling gear and to the accommodation for officers and crew.

The vessel was gracefully christened by Mrs. H. B. Smith, wife of the president of The Collingwood Shipbuilding Company, and the picture of the launching group shows Mrs. Smith, and on her right, Mr. H. B. Smith, president, and on her left, Mr. John S. Leitch, managing-director of the company.

LAUNCHING THE "CANADIAN ROVER."

SHOWING BROKEN THRUST SHAFT.

A DEFECTIVE THRUST SHAFT

The illustration is from a photograph of the thrust shaft of H. M. Trawler Cerealia, employed on escorting duty from Alexandria as a base. The photograph was received from a member of the Institute, and as it appeared to be a somewhat unique case, he was invited to send particulars, and he reported as follows:

"The engineer of the Cerealia reported that the shaft appeared to be running out of line at full speed. I was sent out for a trial run and noticed the same thing. I had the shaft cleaned and carefully examined, and then found a crack extending along the shaft between two of the thrust collars and transversely for two inches up one collar. On trying a .04 feeler, it entered the crack approximately three inches. We decided to drill a ¼-inch hole down into the crack to try to find the extent of same. After drilling down about ⅜ inch with a long twist drill, the drill fell through into the shaft. We could then see, on pulling out the drill, that the shaft appeared hollow, though it was supposed to be solid. As the ships were going to lie for a thorough overhaul, we cabled home to find out if there was a spare shaft at the makers. The reply was in the affirmative, so we got the Admiralty to have it sent out as soon as possible. In the meantime, we disconnected and lifted out the defective one. The new shaft came out very quickly, and was fitted in place. It was then decided to saw through the defective shaft about the middle of the crack where we had drilled. The two parts, I believe, are still at the Arsenal of the Egyptian Government, Alexandria. Engineers visiting there would be shown it with pleasure, I feel sure, by Mr. J. Purvis, who is in charge of the shops. It is well worth seeing, for it is wonderful how the shaft held together for so long.—Transactions, Institute of Marine Engineers.

Coal As a Future Source of Oil Supply

A Paper Read Before the Institution of Petroleum Technologists in Great Britain—The Author Traces a System of Utilizing More Fully the Heat Value of Coal

By SIR ARTHUR DUCKHAM, K.C.B., M.I.C.E.

At the outset of a lecture delivered last week, Sir Arthur Duckham said he had arrived at the conclusion that it was impossible to make any definite statement at the present time as to the best method of treating coal to obtain maximum value in oils and tars. It was necessary to free one's mind from old opinions, and formulate lines of progress in accordance with the changed circumstances brought about by the war. The needs of the community had become more and more complex with the growth of civilization, and to meet them an improved supply of heat, light, and power was essential. As the discovery and exploitation of coal measures in Great Britain, and the rapid application to industry of the energy so provided, had given this country a tremendous start in industrial development, so the discovery of mineral oil in the United States had given a fresh impetus to the production of energy. Used first as a source of heat and, therefore, power through the medium of steam boilers, it was only tardily recognized that the products of the crude oil, used as a direct power producer in internal-combustion engines, provided means of transport which had since revolutionized the domestic and industrial life of the community. With the growth of the population and its increased needs the railways had become congested, and the problem of street traffic one of great difficulty. At the present time, although the community was not obtaining the same quantity of fuel as in pre-war days, it required a greater expenditure of energy derived from fuel per head of the population than ever before. In the future it was doubtful whether transport facilities could be afforded for moving coal on congested railway lines leading to large towns. The transport of solid fuel and ashes through congested streets would have to be restricted. The labour for such work could not be afforded, nor would it be possible to obtain labour in the future for handling solid fuel, or for clearing and removing ashes from boilers, furnaces and grates. Oil fuel would replace solid fuel for marine work. Liquid fuel (including a mixture of solid and liquid fuels in the state known as "colloidal") would replace solid fuel for locomotives also; so that a colossal and ever-increasing demand for oil fuel would be brought about. At the present time, however, there was a shortage of liquid fuel; the demand exceeded the supply already, and would expand many times were it not for the high cost. With regard to other sources of energy, electricity was undoubtedly a convenient and economical method of transmitting energy for light and power purposes, but the generation and transmission of electrical energy for the purpose of providing heat units would not meet the case. There remained one other method of transmitting heat units from the coal pit to the industrial or domestic user—gas, and he believed the industrial future of this country lay in the conversion of coal at the pit head into liquid and gaseous fuels. Liquid fuel would be used for providing energy for all transport on land, sea, and air, while gaseous fuel would be used direct for the great majority of heating purposes and for the generation of electricity. The supply of oil fuel was a necessity, and the only source available in this country was the coal fields.

Dealing with the different processes for the heat treatment of coal for the purpose of transforming heat units from solid to gaseous and liquid forms, Sir Arthur said the best-known method was the carbonization of coal at gasworks, which had for its prime object the manufacture of coal gas for lighting purposes. Starting as a low-temperature process, it had gradually become a high-temperature one, and an all-round improvement had resulted. There were two forms of carbonizing plant in use at gasworks—horizontal fireclay retorts, charged and discharged by means of machinery, and vertical retorts constructed so that the coal travelled continuously through by gravity. The advantage of the horizontal retorts was that they already existed in most works, had a low capital cost, and could be readily adapted to treat varying forms of coal. Their disadvantages were obvious. They took up a large ground space, imposed arduous conditions on the workmen, required a large amount of labour, wasted heat in the discharge of hot coke, and caused an unavoidable nuisance by smoke, dust, and steam. The advantages of the vertical retorts were the small ground space required, absence of all nuisance, good working conditions, and increased make of gas and residuals. Disadvantages were high capital cost and the sensitiveness of the retorts to changes in the quality of the coal. During the war the heat in the coke was utilized for the formation of water gas by passing steam over it. A development of that process was to increase the temperatures about the bottom of the retorts and highly to superheat the steam before it entered them. From a national standpoint, he objected to the conveyance of coal to the gasworks and the removal of coke. The coal pit was the proper place to make gas, and pipe line the proper means of conveying heat units thence to the centres of distribution. The vertical retort gave better tar oil results than the horizontal retort; carbonization of coal in the former was really fractional destructive distillation. The products of distillation were drawn away as made, and had to pass through no higher temperature than that at which they were evolved, while if water gas was made at the same time in the retort, the process protected the hydrocarbons and gave a greater amount of lighter quality tar.

He thought there were big developments ahead for coke ovens. The surplus gas would be utilized and supplied in bulk to the nearest gas undertaking for distribution. Improvements in working would have to be adopted, however; at present the quality of gas from coke ovens varied too much. He believed that in the future gas, not coke, would be used to smelt iron ore. If that was so, coke ovens would be eliminated.

For many industrial purposes, such as steel manufacture, it was essential to have a large supply of heat units in the form of gas at low cost. Solid fuel was, therefore, gasified in producers and a poor gas of about 110 to 130 B.T.U.'s obtained. He had never met anyone yet who was really satisfied with his producer plant. They fulfilled a definite purpose, but they were subject to moods. Their great drawback was that the tar oils recovered were not valuable.

With regard to low temperature carbonization, a tremendous amount of fine work had been done and enormous sums of money expended on the process, but at the present time there was not one large commercial plant in successful operation in Great Britain.

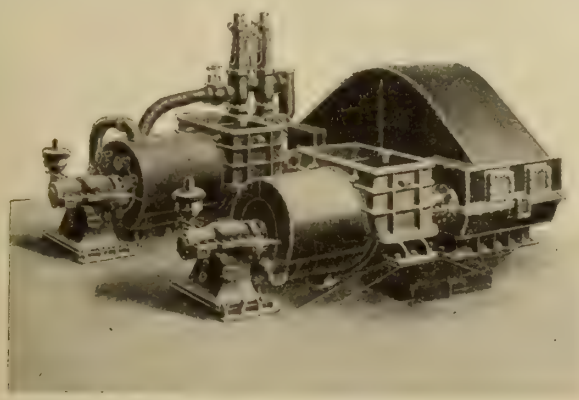
In conclusion, Sir Arthur said: "I venture to formulate a system of manufacture to meet the demand for liquid and gaseous fuels for practically all purposes. The total gasification of coal is essential, preferably in one vessel. The plant must be economical in first cost, and low in labor charges, but above all the maximum amount of the volatiles in the coal must be recovered in a liquid form, being distilled over at such temperatures and in such a manner that a minimum of cracking takes place. The gas afterwards should be stripped of all saturated hydrocarbons and supplied to the consumer constant in heat value and specific gravity. Further, special care must be taken to preserve the ammonia obtained from the nitrogen in the coal. The plant must be designed to work

with the widest varieties of coal, but I do not believe it possible to design a plant of this type capable of working greatly varying coal over short periods, or of working coal containing, say, over 60 to 70 per cent. of fines. The form of plant I would suggest is one or more vertical retorts superimposed over a water-gas producer, the retorts being so constructed and heated that even difficult coals like Durham will work through without undue attention, and the coal fully converted into coke before entering the producer. The producer should be built and worked to obviate the formation of hard clinker, with mechanical grates for the continuous and clean removal of the ash. Automatic compensating devices would have to be included for the regulation of the pressure in the retorts during the run and blow periods. Such a plant, fitted with recuperators and waste heat boilers, would have a very efficient heat cycle, which would undoubtedly result in a large conservation of fuel. If the major portion of the coal used in this country were first treated by such a process, the fuel oil position would be made much easier, as greatly-increased supplies would be forthcoming. The demand would accordingly greatly increase, and as far as I can calculate, gas could be distributed to consumers at from one-and-a-half times to twice the amount it would cost per heat unit to supply as solid fuel. The saving in labor and transport, the cleanliness, and the increased efficiency of utilization would far more than compensate for this increased charge."

Geared Turbines for Swedish Battleships

EARLY in the coming fall, Sweden will try out its two new coast defense battleships, the Drottning Victoria and the Gustaf V. These vessels are 396 feet long, have beam of 64 feet, draught of 21 feet, displace 7,000 tons, and will have maximum speeds of 22½ knots. The main batteries consist of four 11-inch and eight 6-inch guns, and the main armor belt is eight inches thick.

The propelling equipment of each of the ships consists of two Westinghouse turbines, which are rated at 22,000 s.h.p., and drive the two propellers through floating frame reduction gears. The turbines were built in accordance with Westinghouse designs by the Motala Verkstads Nya Aktisbolag, at Motala, Sweden, and the gears were designed and built by the machine works of the Westinghouse Electric & Mfg. Co., at East Pittsburgh, Pa.



GENERAL VIEW OF TURBINES

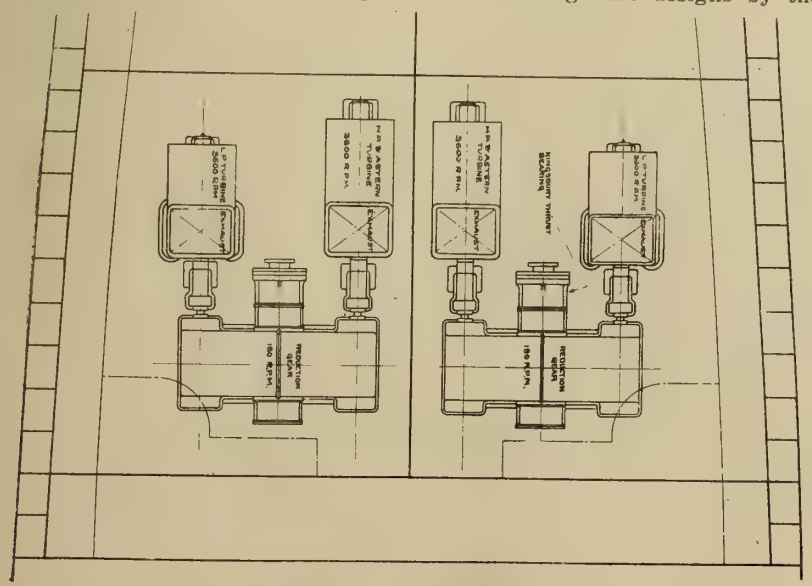


DIAGRAM OF ARRANGEMENT

Each turbine consists of two separate units, rated at 5,500 s.h.p. each, which drive a propeller through a common gear. Steam from the boiler enters the high pressure unit and passes through a set of impulse blades. It then divides into two parts, one of which continues through the high pressure unit, while the other goes into the low pressure unit. In both units the steam is fully expanded in reaction blading and passes into the condenser through a common discharge.

The chief advantage of this arrangement, which is known as the "divided-flow," is that all four units are available for propelling the ship at maximum speeds; but for ordinary cruising speeds, the low pressure units can be cut out, and the ship propelled by the high pressure units only. These, being of the complete expansion type, produce low speeds with good economy. Should an accident put a high pressure unit out of commission, the ship can be propelled by the low pressure units, which are designed to receive steam at boiler pressures. When any unit is out of use, it usually turns idly in a vacuum, but it can be mechanically disconnected.

The divided-flow turbine is not quite as efficient for full speed operation as the cross-compound turbine, in which effected in the high pressure unit, and the rest in the low pressure unit. It is, however, more efficient at low speeds because one unit can be cut out, and this makes it especially applicable to naval service. In addition it can be operated at somewhat higher speeds, which tends to counterbalance its slightly poorer efficiency.

The performance of the Swedish turbines, with steam at 265 lbs., and a vacuum of 28.27 inches, is as follows:

Speed, knots ...	22½	20	12½
Propeller R.P.M.	200	177	115
Turbine R.P.M..	3,600	3,186	2,070
S.M.P.	22,000	15,000	3,150
Steam consumption—			
lbs. per S.H.P.	10.9	11.1	13.3

The water rate at 12½ knots is for operation with the high pressure units only. Were all four units, lightly loaded, used to obtain this speed the water rate would be about 17 lbs.

Port Colborne.—The barge No. 2 in tow of the tugs Metak and Mary Francis Whaler, coal laden from Erie to Montreal, foundered about twenty-five miles off Port Colborne recently. No lives were lost. The barge Allen was owned by the Kirkwoss Steamship Co., of Montreal. The barge Scotia, owned by the Doty Engine Co., of Toronto, is sunk at Erie and will be a total loss.

Gas Engine Drive and Turbine Pumps

The Pumping Work of a Large Dry Dock is Very Efficiently and Economically Performed by Gas Engine Running on Producer Gas, Showing the Possibilities of This Type of Prime Mover

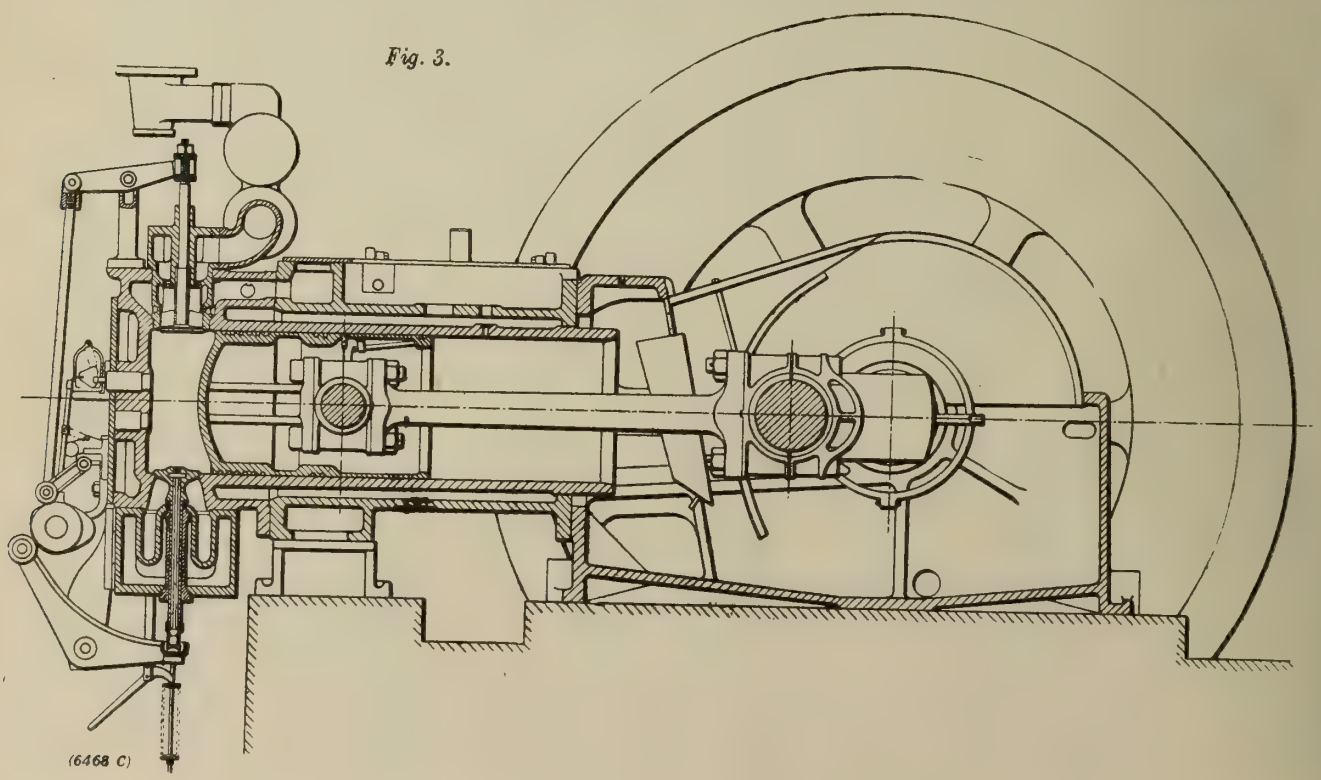
DURING a critical period of the war, the engineers for the Port of London Authority were called upon materially to reduce the time required to pump out the dry docks at Tilbury, which were then being used for the examination and repair of torpedo craft and other vessels for the Admiralty. It was recognised that the existing steam pumps had become obsolete and needed replacing. A thorough investigation was, therefore, made into the respective merits of centrifugal pumps driven either by "gas," "oil" (Diesel) or "steam" engines, and the decision was given in favour of gas engines to operate from producer gas, and using anthracite as fuel. Two sets of multi-cylinder gas engines were built and installed by the Premier Gas Engine Co., Limited, Sandiacre, near Nottingham (now associated with Messrs. Crossley Brothers, Limited, Manchester). Each engine is coupled directly through its crankshaft to a centrifugal pump made by Messrs. Gwynnes, Limited, of Hammersmith. By the courtesy of Mr. C. R. S. Kirkpatrick, chief engineer to the Port of London Authority, we are able to illustrate and describe this interesting plant.

A diagram of the performance of the pumps and a general lay-out of the installation are given in Figs. 1 and 2 on this and the opposite pages, while Fig. 3, on the opposite page, is a cross-section of one of the engines. As will be seen from these illustrations the engines and pumps are arranged in a deep pit, or chamber, forming an engine room with sloping walls. The general appearance of the plant is well indicated in the general views given in Fig. 4 and Fig. 5, on page 534. By sinking the pumps in this manner the suction is materially reduced, and under certain tidal conditions a drowned suction is obtained. This latter makes it possible to obtain the maximum efficiency for the centrifugal pumps. The water enters each pump through piping connected to large drainage culverts arranged below the engine-house floor, and in communication with the various docks to be de-watered. The Gwynne pump impellers are of the double-inlet type with shrouded vanes, smooth finished and carefully balanced. The charging of the pumps, when necessary, is effected by electrically-driven duplex wet vacuum pumps made by Messrs. F. W. Brackett & Co., Limited, Colchester. These pumps are gear-driven, the gear-box being so arranged that when the pumps are working on vacuum only, they operate at a speed of 92 r.p.m. When it is desired that the pumps should run pumping all water, the ratio of the gears is such as to obtain a reduced speed of 18 r.p.m. A charging pump is provided to each main centrifugal pump, these charging pumps being erected one at each end of the engine-house, as may be seen in Fig. 4 and Fig. 5.

Prior to installing the gas-driven pumping sets the engine-house contained four sets of steam-driven pumps, and the positions of the centrifugal pumps were determined by the existing delivery pipes, which pass through one side of the chamber and are connected with the open channel or discharge pit. Two of the four original pipes were made use of, and the remaining two were blanked off. The delivery from the centrifugal pumps is coupled with a large sluice valve which has a graduated indicator plate above, showing the exact amount of opening at the sluice valve. The opening and closing of this valve is operated by hydraulic pressure at 500 lbs. per square inch to 750 lbs. per square inch, and controlled by slide valves on the supply pipe from the hydraulic main. The sluice valves are each 44 in. diameter, being of the full-way wedge-gate type, made by Messrs. J. Blakeborough & Sons, Limited, Brighouse.

Referring now in more detail to the main pumping sets, it may be said that these consist of two "Premier" four-cylinder horizontal gas engines, each of 368 brake horse-power at normal load, and connected by a flanged coupling on the engine shaft to a Gwynne Invincible centrifugal pump. The speed is 200

Fig. 3.



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SECTIONAL VIEW OF ENGINE

r.p.m. The gas-producing plant comprises three separate units, one of which serves as a stand-by. They were made by the Power Gas Corporation, Limited, of Stockton-on-Tees, and are of the "suction-pressure" type with the usual complement of scrubbing apparatus. The gasplant house is situated about 50 ft. away from the engine-house, their relative positions being shown in Fig. 2. The gas from the producer plant is drawn through the washers and coke scrubbers by an exhauster fan, which also forces the gas, at a pressure of a few inches, through the dry sawdust-scrubbers and into the gas main leading to the engine-house. Starting is by compressed air, and with gas ready at the plant, starting from cold to operation at full speed occupies less than five minutes.

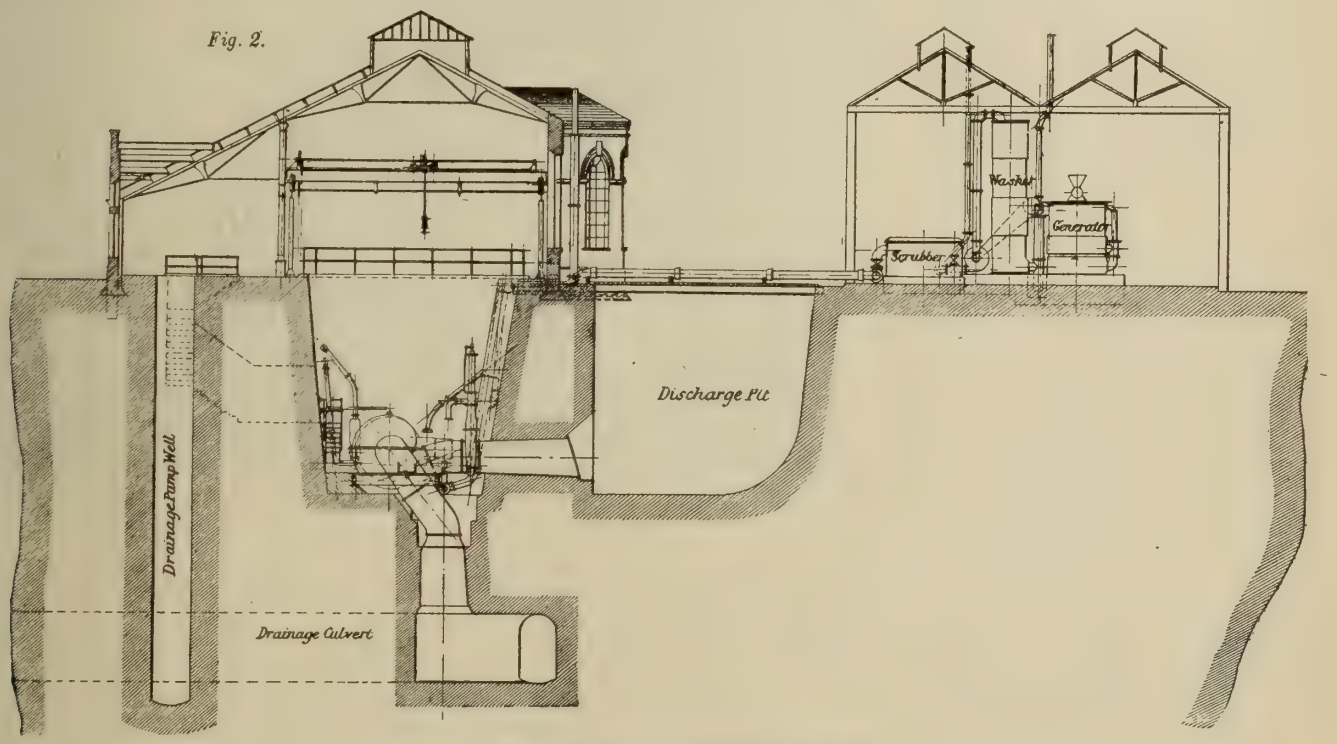
In determining the pump capacity required, it was stipulated in the Port discharge rate of 5,793 cub. ft. per minute—against a variable head of minus 1 to plus 29 ft. (30 ft. total). Test No. 2 gives 10,244 cub. ft. per minute against a variable head of 5 ft. to 33 ft. (28 ft. total). Fig. 1, annexed, is a reproduction of a pumping diagram showing the pump volumes, static and gauge heads, to which the plant had to conform. The chain-dotted line has been plotted from a large number of tests taken during the runing of the sets and represents the average actual volume of water pumped, with one pump only working.

Mention has already been made that compressed air is used for starting the main engines. The air-compressing plant is by Messrs. Reavall & Co., Limited, Ipswich, and of the quadruplex cylinder type, belt - driven (using a jockey pulley) from a 10 h.p. electric motor. The sets are in duplicate, each

to the governor lever. The gas after passing through the throttle valve enters a gas manifold pipe coupled to each of the four cylinders through the admission-valve cages. Air enters separately, so that the gas and air, forming a mixture, only unite inside each admission-valve cage and immediately behind the point of entry into the cylinder. In the event of an occasional back-fire occurring in any one cylinder, this does not disturb the mixture entering the remaining cylinders, and so the governing is not upset. The gas throttle is specially designed to ensure good control and made easily removable for cleaning purposes. In addition, an air throttle valve is provided to each cylinder, so that, if desired, the strength of the firing mixture can be separately adjusted for each cylinder.

The design and construction of cylin-

Fig. 2.



POWER HOUSE AND PRODUCER HOUSE

of London Authority's specification that both pumps operating together should be capable of de-watering the Tilbury Western Dry Dock in three hours, or with one set in six hours, when the dock contained 1,825,000 cub. ft. of water. In actual practice the volume of water in the dry dock depends on the height of the water in main dock. The following figures are interesting and show the results of careful tests made in this direction.

Test No. 1.—One centrifugal pump emptied the large dock in four hours 50 min., when containing 1,680,000 cub. ft. of water.

Test No. 2.—Two centrifugal pumps required 2 hours 40 mins. when the dock contained 1,639,000 cub. ft. of water, and working against the highest tide, 12 in. higher than T.H.W.

In the case of Test No. 1 this gives a

compressor having a capacity of 36 cub. ft. of free air per minute. The air is delivered at a pressure of 200 lbs. per square inch into a riveted steel reservoir, which, as shown in Fig. 5, is carried on brackets from the engine-house wall. The cooling water circulated through the gas-engine jackets is provided by pumps driven from the end of the main centrifugal pump spindles.

In the "Premier" multi-cylinder gas engine the governor and side-shaft, shown in the foreground in Fig. 4, are on the free side of the engine, i.e., on the side away from the flywheel. The governor is of the enclosed centrifugal spring-loaded type, highly sensitive, and is directly driven by skew gears from the engine shaft. The governor controls the admission of gas by means of a central throttle valve and is actuated from a weigh-shaft and connecting-rod coupled

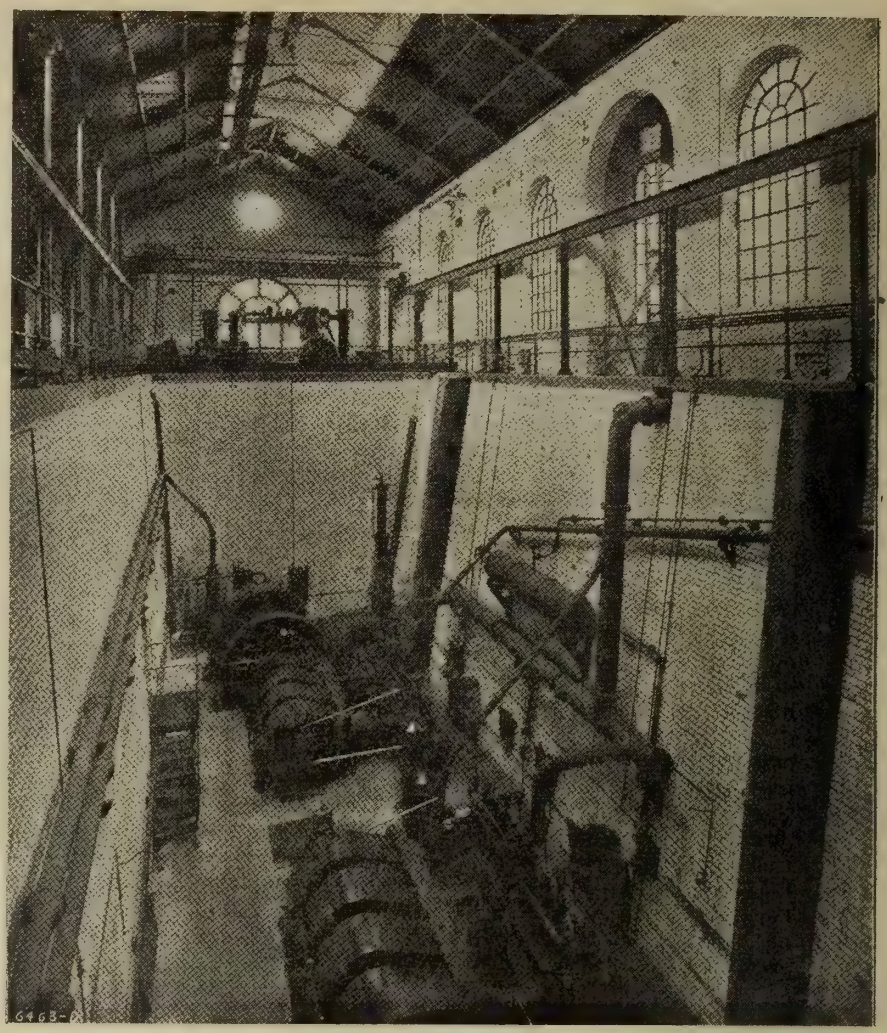
der, combustion-chamber, valves, and cam-operating gear of the engine are clearly shown in Fig. 3. As may be seen, the combustion-chamber is symmetrical in shape and quite free from pockets. The admission valve is large to ensure a full charge entering the cylinder. The exhaust valve, which is placed at the lowest point of the cylinder, is also of liberal proportions to ensure effective discharge of the products of combustion. The shape of the combustion-chamber is such that the clearance volume, when the piston is on the back centre, offers the minimum surface area to the cooling action of the jacket water—thus contributing to the thermal efficiency of the engine. Notwithstanding this, the water passages are ample and give effective cooling where it is most needed.

The design of the cylinder calls for special comment. It will be observed

that this engine has no loose liner—such as is generally understood by that term. The cylinder and breech end are cast integral, and form one plain casting, thus dispensing with the liner joint which is by far the most difficult joint to make and keep tight upon a gas engine cylinder. The advantage claimed for a loose liner is that it can be made of specially hard close-grained cast-iron which is easily renewable when worn. Against this may be instanced the large number of worn liners directly caused by a faulty and leaking liner joint. With the "Premier" design as we have said there is no loose liner, but, on the other hand, the cylinder barrel with breech end form so simple a casting that this can also be made from close-grained metal to withstand wear, and be suitable alike for the cylinder-wall surface and exhaust seating. The back of the breech end is cast open, giving perfect access in the first place for the removal of cores and cleaning the casting. A large cover plate as shown is afterwards attached at the back, which allows for the free expansion of the inside walls when working under heat stress. As the result of this method of construction, cracked or broken breech ends are claimed to be an unknown quantity upon the "Premier" gas engines.

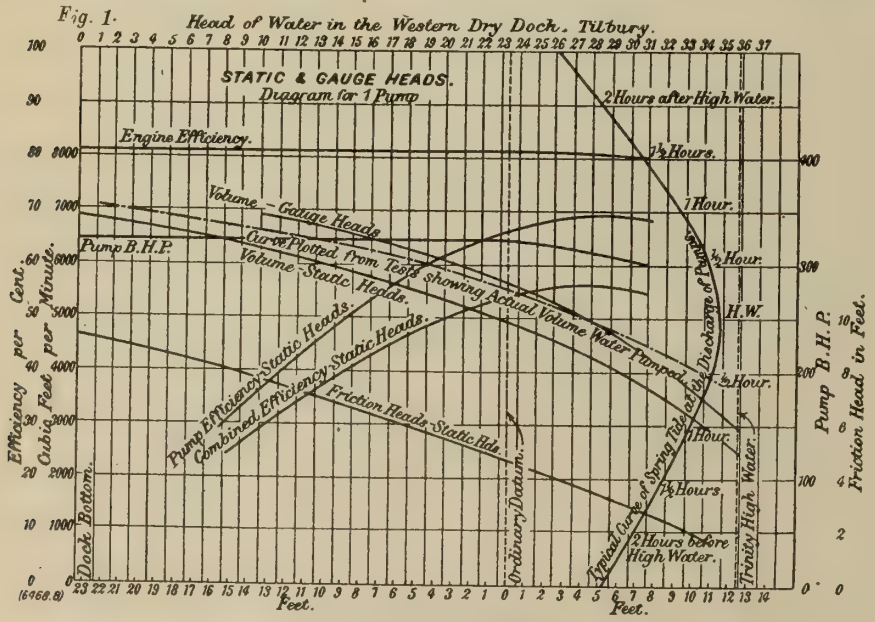
All valves are operated from a cam-shaft running in self-oiling bearings, arranged behind the cylinders and placed so that the breech-end cover-plate previously referred to, can be removed without disturbing the cam-shaft. The removal of the cover-plate affords perfect access to the interior of each water-jacket for cleaning away scale or sediment which usually forms around the hottest portion of gas-engine jackets. Each inlet-valve cage is complete with a gas valve and an admission valve, and fits inside a bored opening at the top of the cylinder. The seating is made with a metal-to-metal ground-in joint, so that the complete inlet-valve cage can be removed quickly. The exhaust valve is placed as shown directly below the admission valve, and is also readily removed through the same top opening. This exhaust valve is water-cooled by means of an internal pipe, passing up the hollow valve spindle, through which cold water passes directly to the head of the valve. Ignition is by low-tension magneto operated by eccentrics driven from the cam-shaft, the timing being adjustable whilst the engine is working. The ignition-plug is placed directly above the centre and at the back of the combustion-chamber, this being the best position to ensure perfect firing of the mixture. Immediately below the ignition plug-hole is arranged the opening for the compressed-air starting valve. The gear for starting up the gas engine by compressed air is fully automatic, consisting of a cam-operated distributing valve which admits compressed air to the cylinders at correct intervals. The gears operating both side-shafts and cam-shaft are of the skew type running in oil baths.

It has been stated at times that the enclosed type of gas engine arranged with forced lubrication is wasteful in regard to oil consumption. Certainly this does not apply to the "Premier" engine, and the engineer at Tilbury Docks testified as to the moderate quantity of lubricating oil used for all purposes on these engines. The supply is by means of an oscillating valveless pump driven

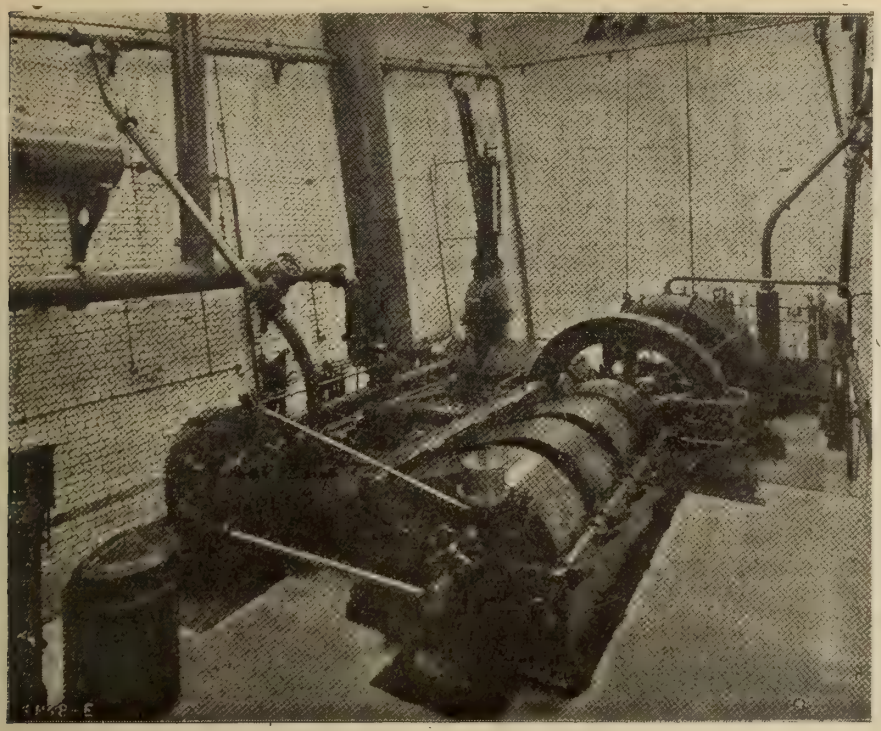


THE PUMPING PIT

Fig. 1.



PUMP CHARACTERISTICS



ONE OF THE UNITS

from the end of the side-shaft, the oil being delivered into boxes placed over each main bearing, and afterwards flowing through by gravity. The quantity of oil delivered into each box can be regulated by hand, and set so that the oil passing to the main and crank-pin bearings is not more than to meet actual requirements. Otherwise, with an enclosed engine there is some possibility of surplus oil lubricating thrown off from the connecting-rod ends, entering the cylinders in excess, and so getting past the pistons into the combustion-chambers, where it is wasted. Tests taken over a period of one month show that only 2-6 gallons of lubricating oil are used per 24 hours. This works out at the rate of 0.0024 of a pint per brake horse-power hour at full load. Part of this oil is recoverable after passing through a filter, and may be used again for shafting lubrication and the like. We are informed that careful tests over long periods show less than 3 cwt. of fuel is used per hour at the producer-gas plant per engine. This is approximately 0.9 lb. per brake horse-power at full load. Calculating the cost of this fuel at 50s. a ton, it works out at 0..24d. per brake horse-power hour.—Engineering.

LIFE OF CONDENSER TUBES

A joint investigation is being undertaken by the General Electric Co. of Schenectady and the Diamond Specialty Co. of Windsor on the subject of the life of condenser tubes. The investigation is undertaken with the object of determining the possibilities of utilizing calorized copper tubes in this field.

Calorizing has, of course, proved its value in preventing oxidation of soot blower units, pyrometer protection tubes and other equipment at points of high temperature. What is not so generally known, however, is that calorizing has been utilized successfully for some time under certain conditions as a means of preventing corrosion.

Information is desired from engineers engaged in both stationary power plant and marine work respecting the service which they are getting from their condenser tubes. The co-operation of such engineers is requested and will be very greatly appreciated. In order to be of value, the reports sent in should contain as specific data as possible on the following points: (A) Metal of which tubes are made, (B) size and length of tubes, (C) life of tubes. Communications on this subject should be addressed to Robert June, Diamond Specialty Company, Windsor, Ontario, Canada.

Toronto.—A conference is being held at the City Hall between the Board of Control, the Board of Trade, the local members of Parliament and the labor representatives of the Shipbuilders' Union with respect to the resumption of work on two Government vessels at the Dominion Shipbuilding Company's yards. Local labor men say they understand that the contract for the completion of the two vessels has been given the Collingwood Shipbuilding Company and that that firm will import its own labor. If such is the case they propose to lodge an objection on the ground that the local employees, who were thrown out of work when the Dominion Shipbuilding Company assigned, should be given the work.

MICA AND ITS USES

Mica is one of the most useful minerals, the production and distribution of which is little known. Of the many varieties, only three are of commercial importance, and of these but two are available in any quantity—the muscovite, or white mica, and the phlogopite, an amber mica. The latter is the most important of Canadian micas.

India is the largest producer of mica, providing over 50 per cent. of the world's supply. Canada produces about 25 per cent., and the United States and other countries the remainder.

In Canada, mica occurs pretty generally. The most productive areas are situated along the lower St. Lawrence below Quebec, north of the Ottawa near Mattawa, and in the townships of Burgess in Leeds county, Lanark in Lanark county, and Loughborough in Frontenac county, also in a few areas in British Columbia. The production of 1919 was valued at $273,305.

Mica mining is attended with many difficulties. For successful exploitation it is essential that the miners be experienced in the mining of this material, and be familiar with the special conditions and problems it presents. Many good mica deposits have been abandoned on account of the lack of experience of the operators.

The general run of mine mica is of a small size. A very small percentage produces sheets of 4 x 6-inch surface, while fully 50 per cent. will cut to 1 x 3 inch sheets only. Fortunately, a process of cementing the small sheets enables the building up of larger surfaces. This product is known as "micanite" or "mica board" and is mostly used in the electrical industry for insulation. Mica is largely used in the manufacture of boiler and steam pipe covering, its insulating properties exceeding by far that of any other known substance. Comparative tests have demonstrated that the loss of heat from bare pipes has been reduced by 90 per cent. when the pipes were enclosed in mica covering.

Owing to its resistance to shock mica is used for spectacles or goggles worn by workmen in industries where flying chips or sparks endanger the eyes, and in observing processes of melting and fusing in furnaces. The small pieces of mica, formerly wasted, are now used for various purposes. When ground fine in oil, mica forms a valuable lubricant, especially for shafting or journal boxes on locomotives or railway cars. Ground mica, when mixed with a flux, is also used in giving to wallpaper and other substances a silvery effect.

So many uses are being found for mica that what was formerly an industry with a very large proportion of waste is now one in which the material is almost completely utilized.

REPORT is current in marine circles here that the new Merchant Marine (Jones) Bill of the United States will have the effect of driving a considerable portion of Japan's shipping from Puget Sound to British Columbia ports. Not only the lines of Japan but of other countries may adopt the same course, as Section 28 of the bill is interpreted as unfairly discriminatory against the vessels of foreign nations, while according extreme privileges to American ships. It is stated that the Nippon Yusen Kaisha, after the beginning of the new year, will include Vancouver, as well as Victoria, as a regular port of call.

In the North European service of the Pacific Steamship Company the steamship Havilah is now on her way from Antwerp to San Francisco, Seattle, Victoria and Vancouver, and other vessels of the same line will also make stops at the two British Columbia ports.

New orders passed by the British Board of Trade stipulate that towering deckloads of lumber may no longer be carried on ships, and this will have effect on British Columbia's lumber trade, as many cargoes carried in the past have extended to almost half the height of the mast.

E. G. McMicken, general passenger agent of the Admiral Line, has been promoted to the office of traffic manager, and Roger Pineo, foreign freight agent, has been appointed freight traffic manager, according to announcement of President A. F. Haines.

The inquiry into the wreck of the Grand Trunk Pacific steamer Prince Rupert, which went aground at Swanson Bay in September, commenced in Vancouver, November 15. The court of inquiry consists of Wreck Commissioner J. D. Macpherson and two assessors, Capt. Gerald Bridge, of Esquimalt, and Capt. John Park, master of the steamship City of Victoria, recently launched at Vancouver.

The coasting steamer Clansman, while moored to Pier H., of the C. P. R., listed over so far that the water poured in through the engine room and sank her. The boat was loaded with salt herring from Chemainus.

The small motorship Teco, has been purchased by the British Columbia Cement Company, of Victoria, for use in carrying cement from the Saanich Inlet and Bamberton plants of the company. The vessel was built by the Taylor Corporation, Ltd., for coastwise work. She is a wooden boat, 125 feet long, with Bolinder engine. The Teco has been operating since June, 1919.

The former sloop of war Shearwater, for years a familiar craft on the Pacific seaboard, is to follow her companion ships of the old Canadian Navy in being scrapped or sold to private interests. According to advices received recently, the Shearwater, which is now lying in Halifax Harbor, will shortly be offered for sale, as she is no longer valuable for naval purposes. The vessel was built in 1889 and for many years was at the Esquimalt station.

Mr. B. C. Keeley, general manager on the Pacific Coast for the Canadian Government Mercantile Marine, recently gave out a statement outlining the policy regarding trans-Pacific trade. In connection with the joint trans-Pacific service of the Blue Funnel Line and the Canadian Government boats, Mr. Keeley said that eastern freight agents of the Canadian National Railways and the Mercantile Marine are now booking freight to China and Japan that will be carried from Vancouver by Blue Funnel (Holt) steamships. Four Government boats, to be decided upon as they are completed by the Wallace Shipyards, the Coughlan Shipyards and the Prince Rupert Yards, will be placed on the orient service to balance four Blue Funnel boats. The idea of operating a feeder service in the Far East for the C. G. M. M. has been abandoned, according to Mr. Keeley, now that it is arranged that the firm of Butterfield & Swire, Blue Funnel agents, will look after the securing of cargoes for the eastbound trip. It is at present planned, said Mr. Keeley, to proceed with the inauguration of a service between Vancouver and India, as previously announced, with the Canadian Inventor, which is now on the Australian run, taking the first sailing from Vancouver in December. It is expected that three steamers will be sufficient for this service. Five will be maintained in the Australian service, as at present, and these will be put on a regular schedule as soon as possible. The steamer Canadian Importer, now on the way to the United Kingdom from the Antipodes, will return to Vancouver early next Spring. Mr. Keeley is optimistic as to the future of Canada's national fleet and looks for complete success in spite of prevalent shipping depression.

The Vancouver Island Whaling Company, of Victoria, has completed the purchase of four whaling steamers in the United Kingdom, the vessels having originally been intended for Admiralty service during the war. General Manager S. C. Ruck, Chief Engineer W. M. Kelly, and Captain Barney Johnson, of the company staff, are now on their way back to the coast. The boats will be in Victoria in January or February.

Three large passenger and freight liners designed after the Katori Maru type are being built in the Mitsu Bishi dockyard, Nagasaki, for the Nippon Yusen Kaisha and on completion will probably be placed in the trans-Pacific run. Officials of the N. Y. K. have reached the conclusion that vessels of the 10,000- and 20,000-ton type are the most suitable for this trade and seem to be agreed that the day of the leviathan is past. It was reported that the Japanese company proposed to build two super-liners to develop a speed of 25 knots and have larger accommodation than the Canadian Pacific Ocean Service steamships, but this plan has been abandoned.

Following a conference in Victoria between Vice-President D. C. Coleman, of the C. P. R., and Capt. J. W. Troup, manager of the company's British Columbia coast service, steps were taken to have the company's coast steamers converted into coal burners owing to the growing shortage of fuel oil. All the larger vessels in this service are now oil burners, and the company has a contract with the Union Oil Company which does not expire until the end of the year, but the oil situation is so uncertain that it is considered probable that the change will be made.

Shipping companies in British Columbia and agents of shipping lines have been advised that the United States quarantine regulations have been amended so that vessels whose voyages originate in

British Columbia and end at Pacific Coast ports as far south as San Francisco are not required to procure United States consular bills on departure from British Columbia ports nor undergo quarantine inspection on arrival at their destination. The amendment is in force as long as British Columbia has no quarantinable disease. This departure brings the United States regulations in line with the Canadian regulations on the same subject.

Amalgamation of the four big Japanese shipping companies, the Nippon Yusen Kaisha, Osaka Shoshen Kaisha, Toyo Kisen Kaisha and the Kokusai Kaisen Kaisha is being seriously considered in Japan. Baron Rempei Kondo, president of the N. Y. K., is said to favor the plan in principle, although the difficulty in the way of fusing the divergent interests of the four companies appears to be pretty generally recognized.

According to the latest statistics issued by the Japanese Department of Communications, the merchantmen of Japan of not less than 1,000 tons gross number 790 ships all told, totaling 2,636,120 tons gross.

Of these ships 742, with 2,492,717 tons, are registered in Japan proper; 33, with 107,281 tons, in Kwangtung; 12, with 27,548 tons, in Korea, and 3, with 8,574 tons, in Formosa.

Of a total of 790 ships, 21, with 40,611 tons, are owned by the Government; 192, with 911,967 tons, by the "shosen" companies, or the Nippon Yusen Kaisha, the Osaka Shosen Kaisha and the Toyo Kisen Kaisha; and the remaining 577 ships, with 1,678,542 tons, by the "shagaisen" companies, or the concerns other than the three steamship companies mentioned.

The largest owner is the Nippon Yusen Kaisha, whose fleet consists of 100 ships, totaling 481,820 tons, without, of course, including vessels of less than 1,000 tons. Next comes the Osaka Shosen Kaisha with 82 vessels, with 339,948 tons, followed by the Kokusai Kisen Kaisha, with 58, with 311,419 tons, and by the Toyo Kisen Kaisha with 10, with 90,199 tons.

Other owning companies, the number of ships operated and gross tonnage follows:

Mitsui Bussan Kaisha, 19, 66,534 tons gross; Kawasaki Kisen Kaisha, 9, 52,793 tons; Katsuda Kisen Kaisha, 11, 49,466 tons; Tatsuma Kisen Kaisha, 11, 47,287 tons; Kishimoto Kisen Kaisha, 12, 45,291 tons ; Taiyo Kisen Kaisha, 8, 44,968 tons; Yamashita Kiesn Kaisha, 15, 44,262 tons; Uchida Kisen Kaisha, 12, 35,749 tons; Nisshin Kisen Kaisha, 13, 32,767 tons.

The fleets of other "shagaisen" companies total 409, with 953,006 tons.

The percentage of ownership in Japan is 1 per cent. for the Government, 35 per cent. for "shasen" companies, and 64 per cent. for "shagaisen" concerns.

The shipbuilding and ship repair plant of Yarrows, Ltd., Esquimalt, will shortly be extended to meet the increasing demands of business. To gain first hand knowledge of local conditions and make plans for the expansion of the Lang's Cove plant, William W. Marriner, works manager for the big Yarrows yard at Scotstoun, Scotland, paid a recent visit to Esquimalt. Yarrows, Ltd., have specialized in the construction of shallow draft river craft and it is understood that the firm plans further development in this branch of work. Investigation is also being made of the possibilities of manufacturing seaplanes and water skimmers.

The big Canadian-Australian Royal Mail liner, Makura, which has been at the docks of the Bethlehem Steel Company, San Francisco, undergoing repairs, will return to the service between Australia, New Zealand and British Columbia ports about December 15 as an oil burner. The steamer Tahiti is taking the Makura's place on the long run at present, working in conjunction with the Niagara. Conversion into oil burners of steamships plying between this coast and Australia is largely induced by the prevailing coal shortage in Australia and New Zealand, which has reached an acute stage. A large quantity of Vancouver Island coal is now being shipped to the Antipodes, one ship alone, the Waihora, having been chartered to carry 7,500 tons from Nanaimo to Auckland.

The big outer docks at Ogden Point, at the entrance to Victoria Harbor, have been thrown open for general business. The piers are owned by the Dominion Government and form a portion of the Canadian National Railways transcontinental transportation system. During the war and since that time the docks have been used mainly as an assembly plant for wooden steamships constructed in Victoria. The two sheds erected on the piers have a floor space of 700 feet by 80 feet. Arrangements are being made to establish at the docks a concentration base for all overseas export lumber shipments originating on Vancouver Island.

Captain Walter Hose, R.N., who has been appointed director of the Canadian Naval Service, to succeed Admiral Kingsmill, who is retiring, was stationed at Esquimalt during the early years of the war and commanded the cruiser Rainbow. He was later in charge of the Canadian patrol on the Atlantic seaboard, and had much to do with the arrangements for securing the cruisers which the Admiralty has given to the Canadian Navy.

The Grand Trunk Pacific steamship, Prince Rupert, which ran aground in Swanson Bay early in September, is now reported to be resting on an even keel, and the Pacific Salvage Company expects to float the vessel in a couple of weeks. She will probably be taken to Esquimalt for permanent repairs. Investigation into the wreck will probably be undertaken in the immediate future, although Wreck Commissioner J. D. Macpherson has not yet been definitely advised from Ottawa.

Paying a compliment to the capital city of the province, John Coughlan & Sons, Vancouver shipbuilders, have decided to name the nineteenth hull of their building programme and the third ship to be built for their own fleet, City of Victoria. The City of Victoria is an 8,800-ton cargo-carrier.

Private advices received by Edward Farr, general agent for the White Pass & Yukon Railway, are to the effect that the steamer Washburn, which sank in the Little Salmon River 160 miles from White Horse, is a total loss. It was hoped to save the vessel before the ice began running, but this was found impossible. According to Mr. Farr, the past month has been one of the worst from the standpoint of accidents in the annals of Alaska and Yukon interior navigation.

All six of the 6,000-ton passenger and freight liners formerly operated by the Osaka Shoshen Kaisha in the service between the Orient and Seattle and Victoria have been transferred permanently to the Japan-South American route under a government subsidy, according to advices from Japan. Liners of 10,000 tons gross and 18,000 tons displacement have been substituted for these vessels in the north Pacific service, the last of the big ships, the Alabama Maru, having touched here recently on her maiden voyage. The Osaka Shoshen Kaisha's subsidized South American service has already been inaugurated, Buenos Ayres being the South American terminus of the route. The Tacoma Maru will leave Kobe November 26th. Other vessels are booked to sail as follows: Panama Maru, December 25th; Seattle Maru, February 10th; Mexico Maru, March 10th, and Chicago Maru, April 15th. On the return voyage the ships will call in Cuban ports, San Pedro and San Francisco. The new subsidized service, it is said, will have the unlimited backing of the Japanese Government.

Complains of Treatment.—That the Wallace Shipyards at Vancouver had saved the Dominion Government $750,000, but had been refused time for reconsideration when informed that the firm's quotation for the construction of an icebreaker was a few thousands more than the estimate of government engineers, was the statement made by Alfred Wallace to the executive of the Board of Trade, when delivering his inaugural address as its honorary president.

The General Survey of Engines and Boilers

This Article Deals in a Descriptive Manner With the Work Necessary to Put a Ship's Engine Through Lloyd's or Board of Trade Survey

By T. H. FENNER

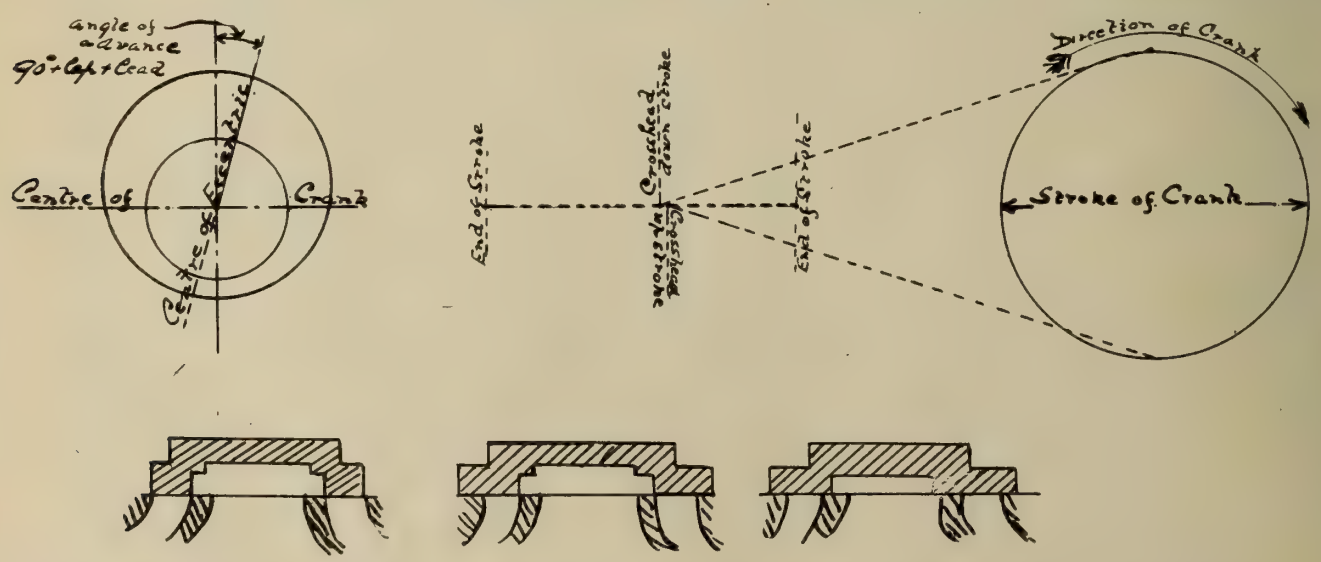
IN our last article we described the staffs that are furnished or must be made for obtaining the lead of valves, when this cannot be measured directly. We propose in this article to talk a little about valve setting, and the methods used.

In the first place, the student, or apprentice, should get out of his mind the atmosphere of mystery connected with valve setting. From the time of Watt, it would seem the seeker after knowledge in the shop has been discouraged in his attempts to find out anything about this secret rite. The writer well-remembers, in his own apprentice days, how the fitters in the shop would shroud themselves in an impenetrable shroud of mystery, only dispelled by the purchase of much beer. However, as the apprentice cannot buy beer for a tradesman any more, there is nothing to be gained by holding back the information. While setting a valve is an operation that must be performed with care and exactness, there is nothing in it that cannot be learned easily by anyone of ordinary intelligence. The actual designing of a valve, of course, is a different matter, but the amount of lap and lead, travel, port opening, etc., are all determined by the designer, and the man setting the valve has only to follow these directions. Of course, after running a while, adjustments are necessary, but these are only determined by examination during overhauling. In marine engines the tendency is always for the valve to become low, owing to wear on eccentric straps and valve spindle end bearings, and this wear is taken up by liners under the foot of the eccentric rod, or sometimes directly under the valve on the spindle. It is never necessary to adjust the eccentric after it is once keyed on in the correct position. Marine eccentrics are always keyed, it being only in stationary practice that eccentric sheaves are secured by set screws.

The Eccentric.

The eccentric is the device used for giving the necessary motion to the slide valve, and is merely a circular disc keyed on to the shaft, with its centre in the same plane as the axis of the shaft, but at a short distance from it. In other words, instead of the rim of the sheave or disc being concentric to the shaft, it is eccentric to it. Hence the name. The eccentric performs exactly the same functions as a crank of the same length as the distance between the centres of shaft and eccentric, and is a much more convenient form for the purpose. The circular motion of the sheave is converted into a reciprocating motion at the valve by the eccentric straps and rod, which thus fulfil the same purpose as the connecting rod does to the crank. The travel of the valve will, of course, be equal to twice the throw of the eccentric, or twice the distance between centres, which is called the throw. The valve must be in a position to open the port to steam at the beginning of the stroke or a little before, and must then move forward enough to get the full port opening, and come back far enough to open the port at the opposite end of the cylinder for the return stroke, while the piston makes one stroke. The valve has made one stroke, but from mid-position back to mid-position instead of from end to end. This means that when the crank is on a centre, the valve crank or eccentric must be half a stroke ahead of it. A full stroke covers 180°, then a half stroke is 90°, and this is the angle of advance for an eccentric when the valve has no lap or lead. That means that the centre line of the eccentric is at right angles to the centre line of the crank, and that when the crank is on the top or bottom centre, the valve will be in the centre of its travel. However, as all valves on the main engines have lap and lead, a correction has to be made for these functions. Lead is the amount that the valve is open to steam at the beginning of the stroke, and lap is the amount by which the edge of the valve covers the steam port when the valve is in mid-position. It is evident that if the valve has lap, it must be moved forward by the amount of that lap to bring the edge of valve and edge of port together, and if it is to be open a certain amount at the beginning of the stroke, it must be brought forward that amount in addition. It has, therefore, been moved forward an amount equal to lap plus lead, and in order to have the eccentric in the correct position to obtain this, the centre line, of the eccentric must be moved from 90° an additional amount, covering lap plus lead. The total amount is known as the angle of advance, and is 90°, plus lap, plus lead.

It will be obvious from the foregoing that every operation of the slide valve will be affected by the position of the eccentric, and a little further thought



TOP LEFT—SHOWING ANGLE OF ADVANCE. TOP RIGHT—SHOWING EFFECT OF CONNECTING ROD. BOTTOM LEFT—VALVE WITHOUT LAP OR LEAD. BOTTOM CENTRE—VALVE WITH STEAM LAP. BOTTOM RIGHT—VALVE WITH STEAM AND EXHAUST LAP.

will show that every operation will be affected in the same manner.

Steam Distribution.

If the eccentric is moved further forward than the 90°, plus lap, plus lead, the effect is to bring the valve forward on the valve face, giving a greater opening than formerly. This means that as the piston moves forward the valve will reach the end of its stroke and start returning proportionately sooner than formerly. Then the outside edge of the valve will cover the steam port earlier, making cut-off earlier. Thus both admission of steam and cut-off have occurred earlier in the piston stroke than formerly. The inside edge of the valve which governs the exhaust will be similarly affected. As the valve has started its return journey earlier, the inside valve edge will uncover the inside edge of the steam port in the face earlier, thus making the point in the stroke where release occurs further from the end of the stroke than before. The return stroke having commenced earlier, will be finished earlier, and a new stroke commenced, thus bringing the valve edge over the inside edge of the port earlier, which, of course, makes compression earlier. These are the four governing points of steam distribution.

If the eccentric is set with less than the normal advance, the effects will be exactly opposite to the foregoing. All the operations will occur later in the stroke. Thus we have the remedy for cases where all operations are either early or late. If all early, the eccentric is too far ahead of the crank, if all late too far back.

Suppose now we find the valve shows too much lead on the top end, and not enough on the bottom, or in other words, the wear has allowed the valve to come lower on the face. The effects will be as follows: The lead on the top will be early, but the cut-off will be late. Opening to exhaust will be late, and closing of exhaust early. On the bottom, opening to steam will be late, cut off early. Opening to exhaust early, and closing late. The remedy is obvious. The valve must be raised bodily by a liner under the foot of the eccentric rod, or under the valve on the spindle. If the valve is too high, we find on the top opening to steam late, cut-off early. Exhaust opening early, cut-off late. On the bottom opening to steam early, cut-off late. Opening to exhaust late, closing to exhaust early. It may be found that all operations are either early or late throughout the stroke, and that the steam is being carried further at one end than the other in addition. This denotes that the eccentric is too far ahead or too far back, according to whether operations are early or late, and that the valve must be adjusted on the spindle either higher or lower, according to whether the top or bottom has the greater port opening. An analysis of the various points will show what is required with a little practice. When the vessel is under way, the operation of the valve can be studied from the indicator card, but we shall not treat that here. It comes under the scope of engine room practice when under way, rather than an overhaul.

Indirect Motion.

There are some special cases where the eccentric must be set directly opposite to the ordinary way. In the case of a piston valve taking steam in the centre, and exhausting over the ends, the eccentric must be set behind the crank the necessary amount instead of ahead of it. This is because in the piston valve the inside edge is the steam edge, and the outside edge the exhaust edge, which is directly opposite to the slide valve. In some ships the low pressure valve is on the back of the low pressure cylinder, and motion is communicated to the valve spindle by a rocking lever from the quadrant. This, of course, reverses the motion of the valve relative to the piston, and in order to correct it, the eccentric is set behind the crank instead of ahead of it.

Valves Without Lap or Lead.

In some turning gear engines, which are made to be reversible without any link motion gear, a single loose eccentric is fitted. There are two stops on the shaft, one 90° ahead and one 90° behind the crank. The engine is pulled over by hand in the direction it is required to run, and the stop comes up against the eccentric and drives it ahead of the crank whichever way it is going. The valve is made without lap or lead, so that when the crank is on either centre, it is just opening to steam at either end. This allows for reversibility. The valves of steering engines are made the same way, but the eccentrics are fixed, the reversing being effected by the control valve, which admits steam to either the outside or inside of the valves which are of the piston type.

The Effect of the Connecting Rod.

It is necessary in all engines, to give a greater amount of lead to the valve on the bottom than the top, or if a horizontal engine, on the crank end. This is due to the connecting rod being at an angle during most of the stroke, and the effect is inversely proportional to the length of the rod. If the rod was infinitely long, the angularity would have no effect, but in the ordinary engine, the rod causes cut-off to take place earlier on the up stroke than the down. The sketch will illustrate this clearly to the student.

MONTREAL NOTES

The navigation season on the St. Lawrence is fast drawing to a close. The wintry weather that commenced about the middle of the month necessitated immediate action on the part of the department of Marine and Fisheries, and a start was made on the 22nd of November on the taking up of the gas buoys in the river, between the harbor of Montreal and the Gulf. These lighted buoys will be replaced by steel buoys for the guidance of such vessels as will ply during the pre-winter season. Navigation practically closes about the 25th of the month, but considerable freight will probably be handled by the smaller vessels well in December.

Capt. Hugh Kane, formerly captain of the Melmore Head, who has been in the service of the Head Line for nearly 20 years, recently arrived in Canada to take the position of Marine Superintendent for the lines operated by McLean, Kennedy, Limited, from Montreal and St. John, N.B. He will assume his new duties at the opening of the winter season at St. John on December 1st.

As a result of the stranding of the Elder Dempster steamer "Chama" off Bellechasse reefs in the St. Lawrence on October 21st and the subsequent inquiry early this month, the pilot, Arthur Baquet, had his license suspended for a period of six months, or until the third of May next. He is also called upon to defray the cost of the investigation. Second officer of the Chama, William T. Lane, was severely reprimanded for his lack of realization of his responsibilities at the time of the accident.

What may prove to be the beginning of a new era in seal fishing was the recent presentation to Newfoundland, by the Imperial Government, of four airships, which are intended for use in aiding the locating of seal herds. It is expected that the maintenance of these blimps will cost in the neighborhood of $60,000 annually, and this expense will be borne jointly by the owners of the sealing vessels and the Government. It is estimated that this system of patrol will be of inestimable value to the industry and the general trade of the country.

The Court of Appeals has granted permission for the completion of the 6,500-ton tanker under construction at the plant of the old Three Rivers Shipyards, for the La Societe Naphthes-Transports, of Marseilles, France. It will be remembered that the work on this vessel was suspended some time ago when the shipyard company went into liquidation. The future owners of the ship have given a

bond to guarantee the payment of the material necessary for the completion of the work. It is expected that delivery of the boat will be made before the close of navigation.

A concerted effort has been made this year, by the Montreal United Pilots' Association, to have the Department of Marine and Fisheries make provision for ships plying between Montreal and Quebec after November 20th to carry an assistant pilot. It is claimed that the severity of the weather after this date is frequently of such a character that pilots often experience excessive fatigue when on continuous duty. This same request was made last year, and was accepted in principle by several of the shipping companies, but due to lack of perfect unanimity the request was not granted.

Work in the development of Courtenay Bay has been making splendid progress. It is stated that early in February of next year the excavation work of the dry dock will be completed. It is expected that the breakwater will be completed about the same time. Good progress has been made in dredging, the soil taken out being used to reclaim some 25 acres of land, which eventually will be utilized for the shops in connection with the dry dock. When present plans are completed, eight berths of 1,000 feet in length each will be available for docking purposes. The total cost will be approximately $1,500,000.

The Fraser, Brace Shipyards have recently completed repairs to the Canadian Recruit, which were sustained when she ran on the Gaspe coast late last year and remained there throughout the entire winter. In addition to the vessel being out of service for the past twelve months the repairs this year will approximate $300,000, representing a heavy loss to the underwriters. In connection with the return of this vessel into commission it is interesting to note that there will be little possibility of a recurrence of last year's conditions, as it is not expected that much shipping will be in the river during the month of December.

With the launching of the Canadian Leader on the 27th of this month from the yard of the Canadian Vickers Company, this firm will have completed approximately 50,000 tons of shipping this year. The Canadian Leader will be the twelfth ship to be constructed by this company for the Canadian Government Merchant Marine. She is a vessel of over 8,000 deadweight tons, 413 feet long, 52 feet beam and 31 feet in depth. She is likewise equipped with an efficient refrigerating system. Two Norwegian vessels are also in course of construction at the Vickers yard, but it is not expected that they will be completed this year.

An interesting marine development was given publicity recently on the arrival of the Italian ship Taranto, Capt. S. Nicovich. This was in connection with the experiment made last year when the Italian Government turned over the Russian steamer Rodosto to the Seamen's Federation of Genoa, to be operated by themselves on a co-operative basis. The fleet now controlled by this association numbers five vessels varying in size from 3,000 to 5,000 tons, trading to all parts of the world. Operating expenses are met by monthly contributions from all sailors belonging to the federation and each in turn are receiving an equal proportion of the earnings. It is claimed that the scheme is working out very satisfactorily. Considerable interest is being shown by independent shipping companies.

Among the late arrivals at the port of Montreal during November was the Italian vessel Monte Grappa, of the Navigazione Libera Triestina, to take on a cargo of grain. The masts of this vessel are of interesting design. She has treble masts with tops in the shape of large platforms; the topmasts are steel right up to the truck and require no stays. The derrick bed plates work in a screw, the object being to swing the derricks from a plumb position over the hatch to over the side of the vessel without the aid of guys. The strake plate is curled on the top edge to minimize the wear on ropes and cables. The bridge protrudes about two feet over the sides of the hull, giving the officers a better field of vision when docking. This is the maiden voyage for this vessel and four other ships of the same type are under construction for the same company.

Grain shipment through the Lachine Canal for the month of October was less than 50 per cent. of that handled for the corresponding month last year. The total grain movement last month was 2,132,700 bushels, as against 4,593,892 for October last year. Of the grain shipments 1,478,312 bushels were in wheat, a decrease over last year of 2,178,907 bushels. The only grain showing an increase was that of flaxseed, the comparative figures being 38,086 bushels in October, 1920, and 14,128 bushels in October last year. Coal shipments were increased, the total being 81,801 tons over that of last year. Last month's shipments in soft coal to the harbor were 156,865 tons; soft coal to the canal for local use 54,019 tons. Hard coal tonnage was 9,173 tons to the harbor for transshipment and 24,801 tons to the canal for domestic consumption. With the exception of butter and cheese, shipments of produce showed increases.

Some conception of the extent of the activities of the Canadian Government Merchant Marine may be gathered from the following, which is a brief summary of the movements of the fleet on the last day of October. In the North Atlantic, or British trade, the Canadian Aviator was discharging cargo at London. At Liverpool the Canadian Ranger and the Canadian Conqueror had arrived, and the Canadian Seigneur was loading for Canada. The Canadian Settler was discharging cargo at Manchester, and the Canadian Trapper at Cardiff. The Canadian Volunteer was unloading at Glasgow and the Canadian Voyageur was taking on cargo at Cardiff. This makes nine National vessels in British ports on that date. The Canadian Miller was loading at Montreal for Liverpool, while the Canadian Carrier, Canadian Navigator, Canadian Signaller, Canadian Otter, and the Canadian Raider were all sailing east on the Atlantic. In the Cuban and Jamaican trade the Canadian Adventurer was homeward bound with a cargo of sulphur. The Canadian Sower was discharging cargo at Quebec, and the Canadian Trader had sailed from Havana for Montreal. In the Barbadoes-Trinidad service the Canadian Beaver had cleared from Sydney, N.S., and the Canadian Farmer from Trinidad for Canada. The Canadian Observer was discharging cargo at Montreal. In the South American trade, the Canadian Victor was loading at Montreal, and the Canadian Planter was unloading at Rio de Janeiro; the Canadian Spinner was unloading at Buenos Ayres. In the newly established Indian trade, from the Atlantic side, the Canadian Pioneer was east of Suez on a voyage to many of the leading ports in India and Java. In the Pacific service, the Canadian Exporter was discharging cargo at Melbourne, Australia, and the Canadian Inventor was on her way from Melbourne to Vancouver.

Montreal.—The local offices of the White Star Dominion Line announce that an eastbound service from Halifax to Hamburg will commence with the sailing of the Mongolia from the Canadian port on December 18th. She will be followed by the Manchuria, and it is understood that there will be two sailings from Halifax each month. Both these vessels are of about 13,639 tons and accommodate saloon and third class passengers.

Vancouver. — The 8,800-ton freight steamer "City of Victoria," recently launched by the Coughlan Shipyards, is claimed to have set a record in building time that is ahead of anything done in the United States or Great Britain. The actual working time on the vessel was 528 hours, or 66 working days of eight hours each.

Newcastle-on-Tyne. — Several more cancellations of contracts for new ships have been noted in the last few days and there is some uneasiness in shipping circles over the outlook. The cancellations are caused, according to a Washington Department of Commerce report, to the high cost of materials and uncertain exchange conditions.

PROGRESS IN NEW EQUIPMENT

There is Here Provided in Compact Form a Monthly Compendium of Shipbuilding and Marine Engineering Auxiliary Product Achievement

FLUE CLEANING RATTLER

The Baird Pneumatic Tool Co., Kansas City, U.S.A., have placed on the market a flue cleaning rattler and unloader as shown in accompanying sketch. This machine is a friction and not a drop rattler. It cleans by friction, first removing the scale, then using this scale in powdered form as a scouring medium.

It is capable of handling, at one rattling, a full set of boiler tubes averaging 250 to 300 flues, cleaning them throughout their entire length inside and out, in from one to six hours, depending upon the hardness of the scale. Any length flues up to 24 feet can be cleaned, the adjustment for length being obtained by a moveable piston head in the drum. A six-inch play permits of a slight lateral motion, but not enough to allow the flues to become tangled and destroyed.

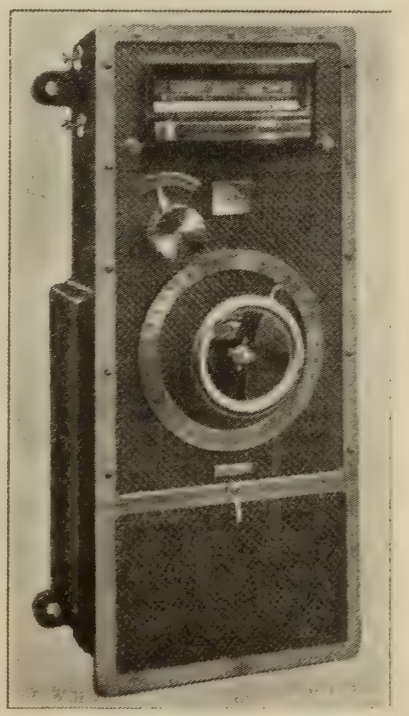
No dust is allowed to escape into the shop as the scale is gradually worked to either end of the rattler, and from there into the dust rooms provided for its accommodation.

The cleaned flues are unloaded by being pushed from the rattler by compressed air out through an end door into a push car, ready to be safe ended and installed.

Power is applied to rattler by either belt or chain, and in some cases by direct motor drive. The machine is adapted for all classes of fire tube boiler flues, handling large diameter super-heater flues as efficiently as the smaller sizes.

AN ELECTRICAL CO_2 RECORDER

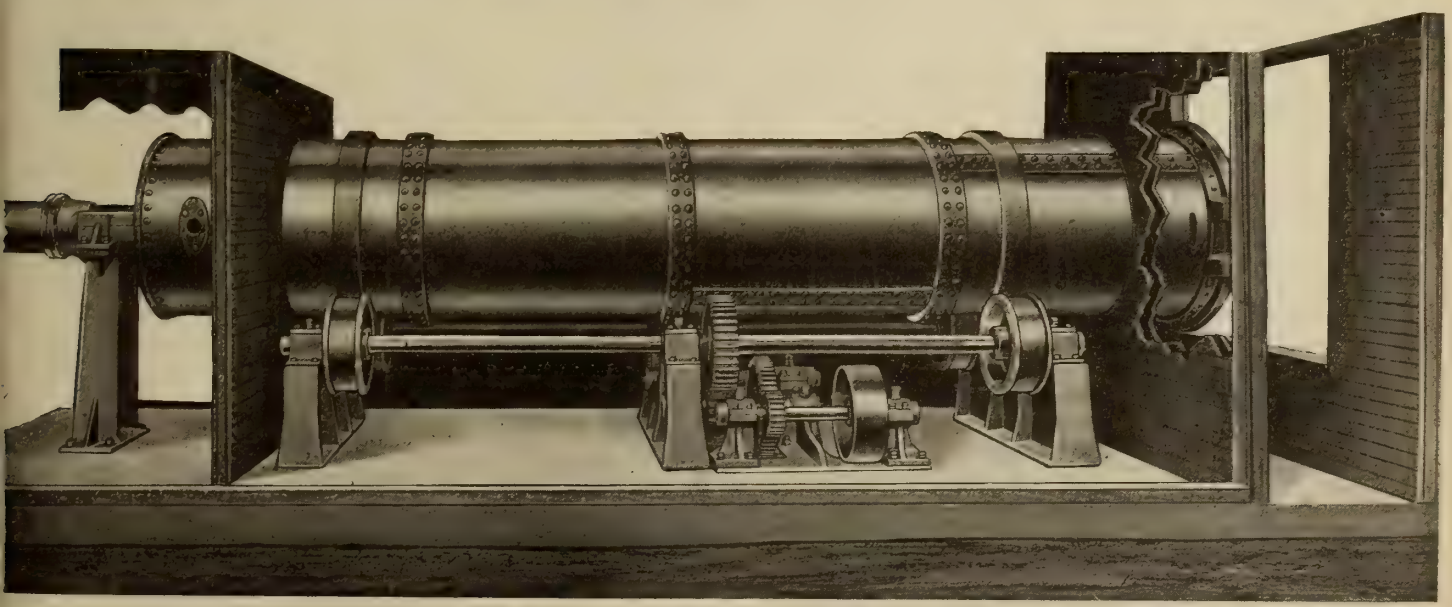
The Cambridge and Paul Instrument Co., of Cambridge and New Southgate, London, England, have been exhibiting at the machinery exhibition at Olympia, London, a novel CO_2 recorder which uses no chemical absorbent. The method has been devised by Dr. Shakespear, of Birmingham University, and employs



ELECTRICAL CO2 RECORDER

an instrument known as as a katharometer, which compares the composition of the flue gases to that of air. The instrument consists of two spirals of platinum placed in two cells formed in a copper block, and each spiral is connected in such a manner that it forms one of the arms of a Wheatstone bridge. If a current of sufficient magnitude is passed through this circuit the platinum spirals will be heated and impart heat to the cells, and if these cells contain gases of different thermal conductivities the spirals will give off their heat at different rates. The resistance of the spirals will vary with their temperature, and this property is taken advantage of by connecting a galvanometer across the circuit. This will give a deflection depending on the difference in the rate of coolint of the spirals, or in other words, the difference in conductivity of the gases in the two cells. If one cell contains a pure gas, and the other the same gas with a further additional constituent, the amount of the deflection of the galvanometer will be a measure of the additional gas. The difference in the thermal conductivity of air and CO_2 makes it possible to employ this method to determine the amount of CO_2 in the flue gases. The machine is described in detail in the "Engineer," as follows

The katharometer and water aspirator are the two principal arrangements used. One of the cells of the katharometer communicates with a chamber through which the flue gases are drawn by the water aspirator, whilst the other cell, which is filled with air, is connected to a tube which contains some water, so that the air in the katharometer is saturated. The method of applying the instrument to a boiler is clearly shown in the cut, from which it will be seen that a soot filter box containing glass wool is connected in circuit with the katharometer—for the purpose of cleaning the gas supplied to the instrument—by the vertical pipes projecting



FLUE CLEANING RATTLER AS INSTALLED INSIDE A PLANT WITH DUST ROOMS ON THE END.

into the side flues. Details of the soot filter are also shown. A final filter is also fitted, as shown, next to the katharometer. The aspirator, it will be noted, is connected up to the water supply and works on the well-known principle. When a sufficient drop in pressure can be obtained behind the economiser a vertical pipe, shown dotted above the aspirating device can be carried directly to the chimney stack instead of using the aspirator for drawing the gas through the meter. Assuming the aspirator to be used, however, the flow of water is adjusted so that it runs freely out of the fine tube at the bottom. The function of the U tube shown on the front of the aspirator is to indicate the presence of any obstruction in the gas supply pipe, and when the aspirator is not working it indicates the chimney draft. The water consumption amounts to approximately five gallons per hour.

The records are obtained by means of a recording thread galvanometer having a suspended coil and a pointer, which is depressed every minute and a-half on to a thread placed just above the revolving drum. This thread is impregnated with ink and every time it touches the chart it makes a mark which records the position of the pointer at the moment it touches the thread. Between the times of marking the pointer is allowed to swing freely to take up its new position. The series of dots obtained forms a record of the varying positions of the pointer, and because of the manner in which the charts are calibrated gives the percentage of CO_2 in the gas tested. The katharometer terminals are connected to the recorder by four-strand lead-covered leads, which may be of any desired length. Current for working the instrument is obtained from a 2-volt, 4-ampere-hour battery.

Electrical Distance Thermometer

Reference should also be made to the company's electrical distance thermometer, an example of which is shown. These thermometers may be used for measuring all kinds of temperatures, such as steam, oil, and air temperatures. Though the instruments were originally introduced for steamship use, they are equally applicable to ordinary power plants and, in fact, may be used in all places where temperatures have to be measured. The instrument from which the temperature is read can be fixed in any position, such as in an office, and by means of a plug switchboard or dial switch, as shown, a number of different circuits connected up to electrical thermometers can be joined to the instrument in succession, so that the switchboard operator can readily ascertain various temperatures without leaving the office or other place in which the indicating instrument is fixed. Other exhibits of the Cambridge and Paul Instrument Company included resistance pyrometers, thermo-electric pyrometers, an electrical pyrometer for locomotives, radiation and optical pyrometers, mercury-in-steel thermometers, dial thermometers of the vapour tension type, draught and pressure gauges, etc.

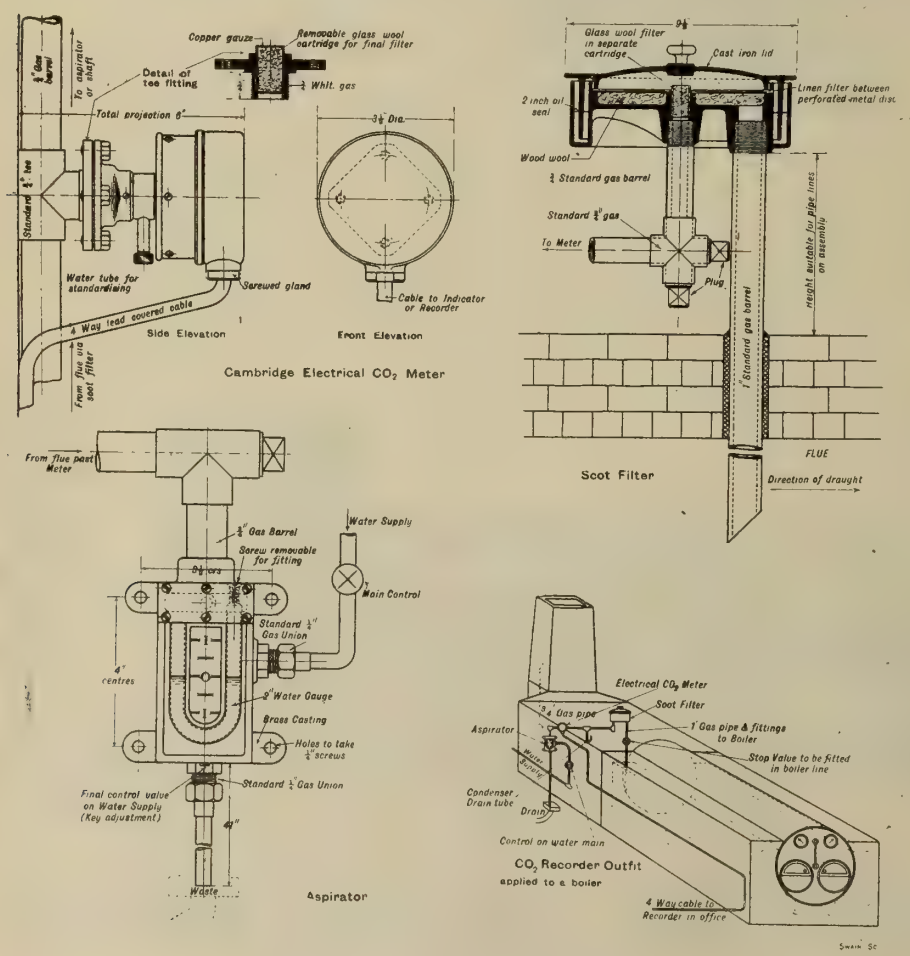


DIAGRAM OF METER CONNECTIONS.

UNIVERSAL GRINDER

The Jones & Shipman, Ltd., Leicester, England, have placed on the Canadian market the universal grinder shown in the illustration. It is known as their model 273 and is used for both internal and cylindrical grinding. There are several features of interest which are herein described.

The columns are high grade castings of rectangular section designed to afford maximum rigidity. The wide spread bases have three-point bearing contacts proportioned to eliminate vibration. The body carries the reducing gear and change feed for the sliding table, together with the clutches for the automatic change feed. The automatic reverse is enclosed in a box on the front. The table is pivoted on a secondary slide provided with a hardened central spigot, and is adjustable for taper grinding by means of a hand-wheel and screw. The setting is registered on a scale reading the taper per foot and the angle in degrees. A T-slot is planed the full length of the table to hold any special work, in addition to the angular slot carrying the work-head and tailstock; the work-heads are pulled up by this angular slot against the master straight-edge in front of the table, ensuring perfect alignment.

The table slide is always covered and guards are provided to exclude grit and water. As it always travels over the full length of the slide-ways of the bed, such slight wear as ultimately occurs is evenly distributed, and accuracy is maintained over the whole length. The traverse is automatic with eight variations of speed, lowest 15 inch, highest 109 inch per minute. The wheel head is of massive construction, ensuring a perfectly steady running wheel. The wheel spindle—of special case-hardened steel—is finished to a high degree of accuracy. The bearings are of phosphor bronze, lubricated with wick feed, with double ball thrust for taking up all end play, and exceptionally well protected against dust. It is bolted on to the swivel table on the cross slide, and can be securely locked in any position. It also carries an adjustable driving bracket for the drive to the internal spindle. The head carrying the internal spindle is a separate fixture mounted on the same swivel table, and is of suitable dimensions to carry super high-speed spindles. The design throughout is carefully proportioned to eliminate all vibration.

The cross slide carries the wheel-head and also the internal grinding head, and is arranged to swivel in a complete circle enabling either the external or internal wheel to be brought into use without disturbing the work; its movements are fully graduated. The cross feed to the

GENERAL VIEW OF THE GRINDER.

wheel head is automatic and variable, and is rendered very sensitive by an arrangement of counter-weighting the cross slide. It is fitted with accurate and reliable trip mechanism for sizing the work. Automatic sizing of work is attained by setting the adjustable knock-out to the required diameter, and engaging the automatic cross feed, which is instantly stopped when the wheel has advanced the predetermined distance.

The work head is fitted to a graduated swivel base on the table. It carries a double pulley to give fast and slow speeds for a large variety of grinding, and is arranged to carry a face plate or chuck, and may also be locked for dead-centre grinding. The tail stock or back centre is of massive design, lever operated, the compression of the spring being so arranged that not only is it adjustable for light and heavy work, but can be set for any given position, thus preventing the centre from pressing into the work more than the desired amount. Its adjustable spring tension accommodates the expansion of the work when grinding. The water service is incorporated in the machine; the water taken is easily accessible for cleaning purposes. A high grade geared pump forces a heavy volume of coolant through flexible armored hose to the adjustable nozzle attached to the wheel guard, the return being through inclined water ways and strainer to a removable filter tray, thence over a weir to a sump and tank.

Lubrication. A sinple and efficient system throughout enables every working surface (which is not already self-oiling) to be readily supplied with oil with a minimum of trouble. Following are the chief dimensions: Capacity between centres, 12 in. dia., 24 in. long; table traverse, 24 in.; table taper adjustment, 30 deg. included; height of work head centres, 6⅛ in.; working surface of table, 43½ in. by 6 in.; cross traverse of wheel slide, 6½ in.

Number of work speeds, 8; number of wheel speeds, 3; size of disc wheel, 10 in. by 1 or 1½ in.; countershaft driving speed, 500 r.p.m.; horsepower, 4½; floor space, 96 in. by 52 in.

SEMI-ROTARY WING PUMPS

Prior to the war the manufacture of these pumps was very largely in the hands of German firms, but since that time British firms have been giving more attention to the production of these articles with a considerable measure of success.

A further extension of this manufacture is indicated in the announcement recently made that the well-known firm of William Beardmore & Co., Ltd., Parkhead Forge Rolling Mills, and Steel Works, Glasgow, have taken up the manufacture of semi-rotary wing pumps and are now in a position to fulfil orders for these.

Messrs. Beardmore are manufacturing these pumps in two different classes, the one being of a cast iron body with solid bronze fitttings, and the other of brass throughout.

Spindles in all cases are of high quality steel, and screwed pipe flanges are fitted to all pumps.

The firm intends to manufacture this pump in 12 different sizes and draws special attention to the complete accessibility for repairs, which can be carried out by removing the cover without disturbing the existing pipe line. The pumps are double acting and easily worked, can be operated either by hand or power, and can be used for lifting or forcing water, oil, petrol, and liquids generally.

The Montreal Board of Trade at a recent meeting had before it a communication from the Jamaican Boards of Trade in which those bodies had passed resolutions endorsing the movement to increase trade relations between Canada and the British West Indies. The letter pointed out a number of impediments to trade which would require adjustment before further action would be taken. The chief obstacle is the present so-called "16 Dutch" standard and color test on Jamaican sugar coming into Canada. The West Indies Boards of Trade are also in favor of a mutual preferential tariff, which, they claim, would not only cement present friendly relations but contribute to a large degree in the extension of trade between the two countries.

The Canadian Vickers Company of Montreal has recently received word from the aviation branch of Vickers Limited of England that the parent company has been awarded first prize of £10,000 as the winner of the amphibian class of aeroplanes. The "Viking" machine was designed by Mr. R. K. Pearson, who also designed the famous and successful "Vickers Vimy." The Viking is fitted with a 450 h.p. Napier engine, is capable of carrying five passengers at a speed of 120 miles per hour, and can be landed on water and driven ashore without any special slipway. It is worthy of note that this is the fourth big prize won by Vickers machines in air or air and water competitions. These include the prize of £10,000 won by the late Sir John Alcock in his flight across the Atlantic, and a like prize won by Sir Ross Smith in his London to Australia flight. It might be well to mention that extensive experimental work has been constantly carried on by the Vickers Company since the armistice in the development of air machines and that the expenditure in this connection far exceeds the amount of the prize just awarded.

Thos. Robb, secretary of the Shipping Federation, has sailed for Europe, where he will represent Canadian shipping interests at the meeting of the League of Nations to be held shortly at Geneva.

MARINE ENGINEERING
OF CANADA

A monthly journal dealing with the progress and development of Merchant and Naval Marine Engineering, Shipbuilding, the building of Harbors and Docks, and containing a record of the latest and best practice throughout the Sea-going World.

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Lloyd's Annual Report

THE annual report of Lloyd's Register of Shipping is before us once again, and as usual, is full of interesting facts and figures. The Society's year ends June 30th, and this is the first complete year since the war to be reviewed. During the time under review, the Society have classed over 4,250,000 tons of shipping, the tonnage classed in the previous year being 3,800,000. At the end of June there was a tonnage of 4,930,340 merchant shipping under construction, and under the Society's survey with a view to classification. These are big figures, but the large amount of reconditioning and conversion of vessels undertaken since the armistice has had the effect of lessening the new construction figures. The total number of vessels classed in Lloyd's Register was 9,587 and their total tonnage was over 25,000,000, gross, and over 96 per cent. of this tonnage were iron or steel steamers. The figures for the last six years of tonnage classed afford an interesting comparison. For instance the total tonnage of steam and sail in 1914-15 was 1,295,623 tons. In 1915-16, 790,209; 1916-17, 1,376,125; 1917-18, 2,569,124; 1918-19, 3,801,221; 1919-20, 4,253,523.

The report notes that there is a large increase in the number of large sized vessels under construction, there being at the end of the current year 56 vessels of 10,000 tons and over building under the Society's classification. It is interesting to note that there were 121 vessels of 740,430 tons built upon the Isherwood system during the year under review and of these 43 of 253,975 tons were oil tankers.

In view of the great interest taken lately in oil fuel and the internal combustion engine, the following figures of the various kinds of fuel used will be illuminating. Vessels using coal as fuel represent 76 per cent. of the total in Lloyd's Book, 16.3 are fitted for the use of oil fuel, while only 1.7 are fitted with internal combustion engines. The sailing vessel with no auxiliary power is now only represented by 6 per cent. of the total. Compared with the previous year the figures show a decrease of 6 per cent. in coal burning vessels, which is reflected in the increase of 6 per cent. oil fuel vessels, or strictly speaking 5.8 per cent. oil fuel vessels, and an increase of .2 per cent. oil-engine vessels. The sailing ship percentage remains stationary in both years.

There is no question of the increasing use of the oil engine however. During the year under review 28 vessels of practically 80,000 tons have been classed by the Society which are propelled by oil engines, and there are under construction under the Society's supervision nearly 150 sets of Diesel engines, and about the same number of oil engines not Diesels.

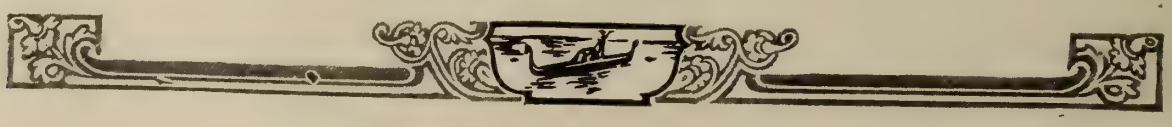
The geared turbine shows its popularity by the fact that 245 vessels with a tonnage of 1,286,046 were classed during the year.

The Society now has a committee in France, on the same lines as the Committee of Lloyd's Register in America, and also one in Sweden. The Swedish office followed soon after the establishment of the French branch. These committees are composed of the leading shipowners, underwriters, and shipbuilders in the country that the committee operates in.

Following a conference in Christiania which was attended by representatives of Lloyds' and several of the Continental classification societies, the freeboard of Norwegian vessels of the shelter deck type was put on the same footing as that of other country ships.

Some of the work undertaken by the Society consisted of the investigation of various technical questions, such as the subdivision of passenger vessels, the precautions to be adopted on passenger vessels carrying oil fuel, bilge pumping arrangements in passenger vessels, experiments on riveted joints, standardization of the rules for the construction of marine boilers, rules for electric fittings on vessels, etc. The scope of the society's efforts in the direction of making life and property safe at sea is almost without limit, and it is to be noted that the Board of Trade technical staff and the staff of Lloyd's work together with the greatest harmony for the general benefit of the mercantile marine. To encourage education the society offer a number of scholarships in Naval Architecture and Marine Engineering each of the value of one hundred pounds. There are 9 in Naval Architecture and 5 in Marine Engineering.

The report is a very interesting account of the activities of one of the world's remarkable institutions. What the Society of Lloyd's has meant to British shipping since its inception is something that cannot be measured in the ordinary way. It is pleasing to note that the scope of the Society's activities is constantly increasing, and that the well-merited confidence of shipowners all over the world is still placed in this, the greatest classification society in the world.



News of The Shipping World

THE Cammell-Laird Fullagar engine that was installed in the electrically welded ship "Fullagar" some time ago, and which was fully described at that time, has now been in service long enough to prove its capabilities. The vessel has made a large number of trips on the coast, totalling about 10,000 miles, and has experienced no engine troubles during that time. The engine it may be remembered, is of a type developed by the builders, Messrs. Cammell-Laird & Co., and is of the opposed piston type, two cycle, each unit consisting of two cylinders and four pistons. The top piston of one cylinder is connected to the bottom piston of the other cylinder by diagonal rods, so that the outward motion of the pistons in one cylinder causes the inward motion of the pistons in the other cylinder. Compressed air for the scavenging of the cylinders is obtained from square pistons situated on the top of the cylinders, and driven by the main piston rods. The "Fullagar" has two of these units, or four cylinders in all. The owners are so well satisfied with the results obtained, that they have ordered a vessel of 4,000 tons, and the engine now in the Fullagar will be taken out and placed in the new ship, together with a new engine of the same size. The same owners have another motor ship building on the Clyde, which will be fitted with two Cammell-Laird Fullagar engines of 1,000 b.h.p. each. This vessel will be on the Eastern run when completed. Other engineering firms have now taken out licenses for this type of engine, and it will be probably but a comparatively short time before vessels having engines of 10,000 h.p. will be constructed with Fullagar engines. The engineers in Great Britain are keeping well ahead in the race for the development of the internal combustion engine. Having gone into it they are going into it with a will and the increasing numbers of high power motor ships making their appearance are the best evidence of the fact.

* * *

THE Coughlan yard at Vancouver recently launched the steamer "City of Victoria," of 8,800 tons deadweight, and claim to have set up a record in the building of steamers of this size. The working time on her up to launching, when she was 98 per cent. complete, was only 66 days. Although vessels of the same size have been brought to the same stage of completion in the same or less number of days in the States during the war, the Coughlan people claim that there were a much larger number of hours included in these days. Their time was just 528 working hours, and the vessel was launched with engines installed, the only work remaining being the lowering of boilers into place, and the riveting up of the casing, and installing the funnel. Vancouver claims to have in their two shipyards, the Coughlan and the Wallace, yards as well equipped and staffed as any on the Continent, and if they can get the raw material in at anything like the same prices as Eastern yards, they can turn out freight steamers in competition with any yards in the world. Let us hope they can get the ships to prove their assertions.

* * *

AN amusing instance of Government departmental stupidity and lack of knowledge of the things they attempt to deal with is that of the Anchor Line "Columbia," which was recently held up, with 1,000 passengers on board through lack of bunker coal. The proper authorities being appealed to, after much consideration offered to let her have 300 tons. What use 300 tons of coal would be to an Atlantic liner about to start on a voyage is apparent to any one familiar with the question of coal consumption. As one commentator in the British shipping press puts it, it would have taken her out of sight of land but not much further. The same writer adds that it is gratifying to know that there are some humorists left, even in the ranks of officialdom.

* * *

THE settlement of the coal strike is viewed with different feelings by different sections of the British press, some sections evidently thinking that the Government, after showing a commendably firm spirit at the beginning of the conflict, backed down to a considerable extent at the finish. Others think that the Government were justified in their procedure, considering the distress that would have ensued by any protracted struggle. The settlement finally arrived at, while giving the miners the increase they ask for, makes it conditional on a certain production being made, failing which a reduction of wages will automatically follow. On the other hand an increase in production will bring an increase in wages. The weak point in the scheme is that while the miners will accept an increase if entitled to it, their past behaviour makes it extremely problematical that they will show a like spirit to any reduction. The miners are not a bit particular about breaking agreements, and repudiate their leaders whenever it suits them to do so. However, it is early yet to make any forecast of the result of the settlement, and we can only hope that it will mean, as some enthusiastic labor man have declared, a truce in the coal trade for the next ten years.

* * *

IN contrast to the good showing made by the Canadian Government fleet of steamers, a good showing made possible only by the fact that the operation of the fleet is in the hands of a practical management, and not a Government department, is the record of the shipbuilding efforts of the National Shipyards in Chepstow, England. The Chepstow yard was started during the war in order to make up the great shortage of merchant ships, but never a ton of new shipping ever came off the ways. Months and months went by while the Government department tinkered and piffled with the yards, and now two years after the armistice, the yards are being dismantled and sold up with their plant by the Disposals Board. Even now however, Government extravagance is shown in the fact that there are nearly $12,000 a week being paid in wages to over 400 men, who are ostensibly clearing up sites of houses that were erected or to be erected for the men who were to build the ships that were never built. It is interesting to note, that the Government, after the armistice, offered the Chepstow yards to the men to operate under their own management, the Governmnt financing them. These exponents of nationalisation, when given a chance to put their theories to the test, refused point blank. The reason they gave for not taking the offer, was that the Government wanted to trap them into something that would be too much for them. However that it is one example of Government handling of commercial enterprises. The same story is to be told of the attempt to build merchant ships in Government dockyards. After the armistice, when naval construction was practically stopped, it was suggested that the dockyards at Devenport and Pembroke should be utilized for merchant shipping, in order to keep the men employed in the dockyards busy, as well as to procure much needed ships. The actual achievement so far amounts to one ship laid down, and the promises of a start on two others in the near future. This is in nearly two years. During that time all the big private yards have made the change from warship building to merchant building where that was necessary, new yards have been planned, laid out, and

ships launched from what was virgin soil at the time of the armistice, and private enterprise has generally adjusted itself without any loss of time. The experiences of the last few years should have had a salutary effect on the minds of those with a passion for Government ownership and control, who are fortunately few in the British Islands. Some of our own enthusiasts ought to look over these records, as well as those of other Governments during the war, before they turn over all the private business of the country to the bureaucrats.

* * *

THE Canadian Government Merchant Marine is one of the few Government owned ventures that seem able to win golden opinions for itself from all sources. The "Syren & Shipping," one of the most influential papers in the British shipping world has the following good words to say about it. The paper in question could never be accused of any predeliction for Government control or ownership in shipping affairs, a feeling which we in general share. We feel with the "Syren and Shipping," that the C.G.M.M. is being run along lines which puts it in equal and fair competition with privately owned ships, contrary to the policy of the United States Shipping Board. The comment is as follows:

"During the past week we have had the opportunity of inspecting two vessels from across the Atlantic belonging to two concerns which may quite well develop into rivals. We refer more in detail to the "Canadian Victor" and to the "Panhandle State" in our "Foreign Shipbuilding" pages. They are owned respectively by the Canadian Government Merchant Marine, Limited, and by the U.S. Shipping Board, the U. S. Mail Steamship Company being the managers of the "Panhandle State," and presumably the ultimate owners. The C.G.M.M. is the subsidiary company formed by the Canadian Government, and managed by the Canadian National Railways, to operate the shipping owned by the State. It is a somewhat noteworthy organization because it is not of the unlimited type usually associated with State ventures. Generally, when a Government embarks on shipping or any other industrial or commercial business, the whole of the asset of the State are behind the venture. This is not the case with Canada. The company has a fixed capital; its shareholders have a limited liability, and it has to stand or fall on its own merits. It follows, therefrom, that it must be conducted on business lines if it is to be a success. It looks to us as though success may be the portion of the C.G.M.M., because its management is willing to begin in a small way; is anxious to co-operate with others; and appears to have no intention of trying to grab the jack pot, as Mr. Hughes seems desirous of doing. The object of this new departure in Canadian commerce is the development of new trade routes and the opening of new markets to Canadian industry and commerce. Of recent years, too, a great deal of Canadian overseas trade has fallen to American ports, and more recently has been carried in American bottoms. To prevent this is a very desirable object, and if, for example, Canadian agricultural machinery is carried to Gothenburg and the Baltic ports under the British flag rather than under the "Stars and Stripes," the results will be all to the good. The United States are not going to assist foreign shipping in any way, and there is no reason why Dominion industry should present cargo to American ships. The C.G.M.M. fleet will be, of course, a liner fleet. It may be that this will not be entirely satisfactory to other liner owners, but we do not anticipate that it will really inconvenience them. The fact that the Cunard, the B.I., and Messrs. Alfred Holt and Co. have become the company's agents is a guarantee that the best brains in the shipping world see bread and butter for all in the various trades. No doubt, too, the company will eventually enter the passenger trade. It is known that there are ambitions in that direction, and even that designs are in the drawing office for a couple of liners. It would be unnatural if there were not. A railroad system of several thousand miles requires feeding with passengers as well as with freight, and the demands of Canada for new blood were never greater than t day. The war has enormously developed her industries and agriculture, and for many years to come there are likely to be many more people anxious to emigrate to the Dominion than there will be tonnage to carry them."

* * *

WITH the election of a President in the U.S. who is a whole souled advocate of an American merchant marine, the shipping press of our neighbours is looking forward to great strides in the enforcement of the recent legislation, which President Wilson has refused to carry out. How much the new President is influenced by his feelings, and how much by the necessity to win the election will only be found out later. Almost at the same time comes the report of the committee that has been investigating the activities of the Shipping Board, and they reiterate all the accusations that have been put forward from various quarters during the Board's existence. These include graft, incompetence, waste, favoritism, and a few other crimes. Nobody seems to be much affected by it, as it is only a preliminary report anyway, and the general view seems to be that there has got to be a certain amount of bungling connected with an effort as big as was the U.S. in the creation of their fleet. Probably there will be found the usual amount of incompetence connected with Government control, besides a modicum of graft, but it is hardly likely that the sweeping charges made will be substantiated. Anything that happens in the country over the border has got to be big, even when it is a wash of dirty linen.

* * *

OCEAN freight rates are generally weaker all round than they were last month. Export business from the U.S. has been very slight, and owing to the strike in England there have been many voyages made in ballast, all of which has reacted on the freight market. The United States Shipping Board have withdrawn some of their biggest vessels, and sent them to Southampton Bay to tie up. Shipping men are, however, looking forward to a better market in the near future, and especially is this the case with old established firms who have regular markets for their vessels, and those with long experience in ship management which makes them capable of getting the most out of a bad situation.

MA FINANSHUL POSEESHUN
Oatmeal
Whusky
Beef (cow)
Up-Goddam
Whusky
Jam
Wages pay day
TOYTLE
Mam! A'm fower an' saxpence oot! Hoots God!
THE ORIGIN OF TARTAN
(IT OBVIOUSLY HAD A FISCAL ONE)
THE SARTORIAL INSPIRATION
"MA FREEND YE MAY THINK YE'RE A SUPRALAPSARIAN BUT YE'LL JUST HAE TO WATCH YERSEL' MICHTY CARREFULLY OR YE'LL BE TUMBLIN' OWER INTO SUBLARSARIANISM WHEN YE'RE LEAST EXPECTIN'."
THE BEGINNINGS OF SCOTTISH THEOLOGY.
(STONE AGE)

BONNIE SCOTLAND IN THE STONE AGE

Enquiries into Marine Disasters

RE S. S. "CHAMA" STRANDING

In the matter of a formal investigation held in the Wreck Commissioner's Court, Montreal, on 3rd November, 1920, before Captain L. A. Demers, F.R.A.S., Dominion Wreck Commissioner, assisted by Captain J. B. Henry and Captain C. J. Stuart, Nautical Assessors, into the causes which led to the stranding of the S. S. "Chama," at or near a place in the River St. Lawrence, called Bellechasse Reefs, or Islets, at 12.45 a.m., October 21st, 1920, whilst in charge of a Quebec Pilot, on a voyage from Montreal to South Africa.

Mr. R. T. Heneker, K.C., represented the Master on behalf of the Imperial Merchant Service Guild; Mr. Geo. H. Shink, appeared for the Pilot.

Captain A. D. Burroughs, Board of Trade Certificate No. 022563, stated that the "Chama" was a steel built vessel, registered in London, official No. 120508, owned by Messrs. Elder, Dempster Co., built in 1905, of 1977 tons net, 3151 tons gross, length 350 ft., beam 43 ft., draught 19 ft. 5 in. aft, 16 ft. 10 in. forward, single screw, triple expansion engine, speed 10 to 12 knots, carrying a crew of 46, including 3 certificated deck officers and 3 engineers, being supplied with all necessary nautical instruments. A deviation of a quarter of a point existed in the standard compass.

The Pilot, Arthur Baquet, embarked at Quebec, the weather being dark, but clear. It had been raining, but afterwards ceased, not preventing lights being seen clearly. Shortly after leaving Quebec, the Second Officer being in charge of the bridge with the Pilot, in whom he had confidence, having had the benefit of his services previously and found them satisfactory, he retired to his room to rest. His room is just below the bridge. At 12.45 a.m. he felt the grinding of the ship on the rocks. He was awake and rushed to the bridge and rang full speed astern, which was maintained for about ten minutes. When it was found by soundings that the ship had made 8 feet of water the engines were stopped and assistance asked, whilst boats were swung out. He noticed that the weather was clear and no haze existed over the land.

Pilot Arthur Baquet has had 15 years' experience with one previous casualty to his record. In a straightforward manner he admitted that he gave, by mistake, the order to port instead of starboard; but never mistook Bellechasse Light for Chane Island. Owing to some haze existing over the land he thought himself further off the light; but, realizing his error, he ordered starboard and full speed astern, the ship striking heavily whilst going full speed. There was at the time a flood tide which was within one hour of high water.

The Wheelsman contradicted the Pilot's evidence in this sense, that he received but one order, that of porting.

The Second Officer, William Thomas Lane, Certificate No. 041692, as well as the Cadet, corroborated the Pilot's evidence with regard to haze, which differs with that of the master in that respect.

Summary.

Whilst the evidence with regard to the clearness of the weather, and the orders given to the Wheelsman, are contradictory still, on the whole, it is not conflicting.

The Pilot was perfectly sober, as well as awake, though seemingly suffered from a temporary cessation of powers to think, which is unaccountable under the circumstances. There is the difference in this case from that of the S. S. "Georgie" stranding, that, whilst in the latter case the weather was misty over the land to such an extent to cause distortion of objects, in the case under review the weather was dark, but perfectly clear.

In view of the statement of happenings the Court renders the following finding:

Finding.

The Court having carefully reviewed the evidence adduced, FINDS that the Master must be exonerated from all blame. His absence from the deck at that time was excusable and permissible.

The Second Officer, William Thomas Lane, Board of Trade Master's Certificate No. 041692, failed to realize the importance of his duties by not assuring himself of the lights that were passed, and were in sight, and when he called the attention of the Pilot that the ship was dangerously nearing the Bellechasse Light, he should have immediately summoned the master. Had he followed the onward progress of the ship the error of porting could have been remedied or prevented timely. Therefore, he is severely reprimanded for his lack of realization of his responsibilities.

The Pilot, Arthur Baquet, if his own admission is accepted, that he did not mistake the Crane Island Light for the Bellechasse Light, and that his order was a mistaken one, ought to have discovered that error sooner than he did, as the ship described and altered the angle between her and the light to the extent of four points or forty-five degrees. There was a whole minute elapsed.

It was only after the look-out man had shouted warning that a rectification was attempted.

For this unaccountable mistake the Court suspends his license for six months from the 3rd of November, 1920, to 3rd of May, 1921, and further orders him to defray the costs of this investigation, the amount of which he will be notified later.

Read in Open Court at Ottawa, this 5th day of November, 1920.

(Sgd.) L. A. Demers,
Dominion Wreck Commissioner.

Concurred in by:

(Sgd.) J. Blanchard Henry,
(Sgd.) C. J. Stuart,
Assessors.

RE S.S. "MONTREAL"—"HENRY B. HALL" COLLISION.

In the matter of a formal investigation held in the Wreck Commissioner's Court, Old Customs House, Montreal, on October 14th and 15th, 1920, before Captain L. A. Demers, assisted by Captain Charles Lapierre and Captain J. B. Henry, as Nautical Assessors, into the causes which led to the collision between the S. S. "Montreal" and S. S. "Henry B. Hall," on the 20th of September, 1920, at or near Sorel, River St. Lawrence.

Mr. A. R. Holden, K.C., represented the interests of the "Henry B. Hall," and Mr. C. A. Barnard, K.C., appeared on behalf of the Canada Steamship Lines, Limited.

The following witnesses were examined: Phillipe Garneau, Pilot of S. S. "Montreal"; Arthur Lalonde, Master of the S. S. "Henry B. Hall"; Gideon Latour, wheelsman of S. S. "Montreal"; Oscar Perron, Pilot of "Henry B. Hall"; Phileas Gouvrement, Lookout on "Montreal"; Emile Delisle, Henry Laliberte, Andrew Boisvert, First Engineer, Second Officer and Wheelsman of "Henry B. Hall, respectively, and on October 15th, Captain F. X. Lafrance.

The "Henry B. Hall" is a wooden steamer 201 ft. long, 36 ft. beam, net tonnage 618, gross 1189, draught 13 ft. 9 in. aft., 5 ft. forward, with a speed of 8 knots, single screw, steeple engines, carrying a crew of 17 men, one certificated officer and engineer, owned by the Wilson Patterson Clifford Co., Ltd., official No. 138094, from Montreal, bound to Levis.

The S. S. "Montreal" is owned by the Canada Steamship Lines, Limited, plying between Montreal and Quebec, wooden built, paddle wheels, gross tonnage 3282, net 2299, length 342 ft., beam 75 ft. 6 in., draught 8½ ft. forward, 11 ft. aft, with a crew of 108, with three certificated officers.

Analysis of Evidence.

The "Montreal" had left her wharf at Sorel bound down. When leaving she backed as far as the long wharf, then began the turning movement so as to head down the river. In doing so she

would, and did show to a down-coming vessel—the "Henry B. Hall" in this instance,—first her green light, then, as she turned, the red light.

At that moment the "Henry B. Hall's" green light was seen, she also going down. When the "Montreal" had partly turned a one-blast signal was given, which remained unanswered by the "Henry B. Hall." On the "Montreal" one three-blast signal given by the "Henry B. Hall" was heard; but those whistles were given to the engine room, not for the information of the "Montreal."

Whilst on the turning movement the after port part of the "Montreal" came in contact with the "Henry B. Hall," inflicting slight damage to herself, also to the "Henry B. Hall's" starboard bow and stem, hence the reason of the inquiry.

The "Henry B. Hall" was coming down mid-channel with a current of 2 to 2½ knots, the weather was clear, and the wind which existed was not strong enough to influence either vessel in its movements.

The pilot avers that he did not know where the "Montreal" was going; that the one blast signal given by the "Montreal" may have been for the information of another steamer also going down astern, and to the south of the "Henry B. Hall."

When at 200 or 300 feet distant the signal to check was given in the engine room, whilst the order to starboard was given. At the same or but an appreciable interval after, the port quarter of the "Montreal" rubbed against the starboard bow, inflicting injury to the stem.

Summary.

In the opinion of the Court the "Montreal" in that evolution of backing and filling showed first her green light, then her red. Her signal of one blast may have meant that she was porting and going to keep the right hand side of the channel. The master said that they were about one mile distance when that signal was given. Again, he avers that he was going up the river, heading in a northwesterly direction. This may have been the case momentarily, whilst evoluting; but it was not his course. She was under a port helm as indicated by the one blast whistle. Therefore, as she was already south, or to the right hand of the "Henry B. Hall," the latter was justified in maintaining her course.

Had the "Montreal" intended going up the river then she had to give away and keep clear of a descending vessel.

The fact that the "Montreal" cannot be turned quickly does not afford an excuse.

The crossing rule is not applicable in this instance,—Article 19,—as the one blast whistle had been given some time before the casualty and when the "Montreal" was south of the "Henry B. Hall."

Lord Esher stated, "When you speak of rules that are to regulate the conduct of people, those rules can only apply to circumstances which must and ought to be known to the people at the time."

In sounding that one blast the "Montreal's" master made a rule of his own, not to indicate to the "Henry B. Hall" as to what she should have done, as Captain Lafrance intimated; but as an information as to the steps the "Montreal" was taking, the Court is of opinion that the "Henry B. Hall" was justified in maintaining her course and speed, and for the additional reason, she was coming down with the current, and in waters which are, to all intents and purposes, considered narrow.

The procedure of the "Henry B. Hall" when collision was imminent, to check and starboard, was proper. Had she gone astern, light as she was,—five feet forward and thirteen feet aft,—she would have neutralized the effect of her helm, as the speed she was going could not have been diminished timely. The result of a full speed astern, or a port helm, would have been extremely disastrous to both vessels.

Hence the finding is as follows:

Finding.

The Court having carefully weighed the evidence adduced, and for the reasons given in the Report, finds that Captain F. X. Lafrance, Certificate No. 1147, is in default for contravention of Article 22, and he is severely reprimanded accordingly.

The pilot, Oscar Perron, of the S. S. "Henry B. Hall," is exonerated from blame.

RE S. S. "GEORGIE" STRANDING

IN the matter of a formal investigation held in the Wreck Commissioner's Court, Old Customs House, Montreal, P.Q., on October 28th, 1920, by Captain L. A. Demers, F.R.A.S., Dominion Wreck Commissioner, assisted by Captain J. Blanchard Henry and Captain Charles Lapierre, acting as Nautical Assessors, into the causes which led to the stranding of the S.S. "Georgie," at about 12.55 p.m., October 21, 1920, at or near a place called Sillery, in the River St. Lawrence.

Messrs. A. W. Atwater, K.C., and L. Beauregard, were the only legal advisers present on behalf of the ship and master.

The witnesses examined were the Master, M. Leprete, Pilot J. B. Angers, 2nd Officer, 4th Engineer and Wheelsman.

The "Georgie" is a steel vessel, built in 1913, of a speed of ten knots, carrying 47 of a crew, including four certificated deck officers and four engineers, her length being 126 metres, and beam 16, drawing at the time of the casualty 18 ft. aft and 11 ft. forward, registered in France, official No. 446858, owned by the Cie Transatlantique Generale. She is of single screw, with triple expansion engines, being supplied with all necessary navigating instruments. The compasses had not been adjusted since she was built, but particular attention was given to observations, the deviation on the standard compass being 7 degrees.

Summary.

The master and his officers were strangers to these waters. The master saw plainly that the ship was nearing piles which can be seen as remnants of old wharves; but did not think necessary to interfere, being under the impression that it was regular and usual to pass close as is done in many localities, and in vicinity of wharves.

The conditions of the weather were not such as to prohibit or prevent a course being followed, objects to be seen, nor of a diminishing or reduced speed.

The evidence throughout, from all witnesses, including the pilot, was remarkably straightforward and intelligent, no attempt being made to establish excuses or subterfuge, which facilitated most agreeably the work of the Court.

The Master and his officers were at their posts, the wheelsman performed his task beyond reproach. The Pilot, J. B. Angers, did not attempt to exculpate himself otherwise than by stating that he thought himself further away.

This is a case where the Court is nonplussed in establishing a reason for altering a course 11 degrees from a first course S. 47 W., which would have led the ship clear of all dangers. Why hug the north shore so closely when so much space was left on the port hand, with plenty of deep water. The only conclusion to draw from this casualty is that after passing the buoy of La Mouche, the pilot's mental powers of observation and judgment became temporarily defective, for some reason which scientists who have established the existence of such temporary conditions, have failed to find a cause for.

Whatever may be the reason this Court which is instructed to enquire where the fault lies for any casualty, must overlook the mental conditions under which the pilot was, or may have been labouring, at the time, unknown to him, and place the blame on him alone.

Therefore, the following finding is given:

Finding.

The Court having carefully reviewed the evidence adduced, which was straightforward in every respect, FINDS that the Master, Maurice Leprete, and his Second Officer, Pierre Lamiotte, must be exonerated from all blame.

Pilot J. B. Angers, who, on his own evidence, and by the records, has had several accidents, is found solely to blame, in that he erred in altering his course as much as 11 degrees, and is therefore found in default for hazardous navigation.

For these reasons the Court does suspend his license for the remainder of the season of 1920, and orders that he defray the costs of the investigation, the amount of which he will be advised later.

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2

MARINE NEWS FROM EVERY SOURCE

Port Dalhousie: — The tug Eleanor was totally destroyed by fire recently, and there was no insurance on her. The only thing that was salved was the boiler, the rest of the vessel being wiped out.

Buffalo: — Some good work was done recently at the central elevator in this port, when 401,000 bushels were unloaded from the steamer "Wilpen" between the hours of 8 a.m. and 5 p.m. At the same time the elevator was loading cars, unloading cars, and loading canal boats.

Vancouver:—It is reported from British Columbia that the Canadian Pacific Railway will be compelled to convert their oil-burning vessels back to coal. The fuel oil situation on the Pacific Coast is said to be very serious, and it is possible that the C.P.R. will also have to convert their passenger ferries to coal.

London.—It is understood that J. W. Norcross, president of the Canada Steamship Lines, has secured large contracts which will be of importance to Canada as a whole, and not only his company. Prospects for the British Empire Steel Corporation were very bright and the Old Country firms had done all possible to help the scheme.

Halifax:—The fishing community of Nova Scotia are contemplating the building of a fishing vessel to bring back the blue ribbon of the Atlantic to the Nova Scotia coast, in next year's races. The vessel will be built as a commercial fishing boat, and shares in her will be offered to everyone in the province who wishes to buy. She will be built on lines which will ensure her being the fastest fishing schooner in North American waters.

Port Huron:—The Reid Wrecking Co. of Sarnia has been declared entitled to retain $5,000 which was paid to it by Charles Kurz of Philadelphia as a 90-day option on the steamer John Sharples. Mr. Kurz claimed that the Sharples did not fulfil the requirements of an ocean-going steamer, but he did not so discover till after making the first payment. Judge E. F. Law held that the Reid Co. was entitled to keep the $5,000 to offset the loss through the failure of the completion of the sale.

Montevideo.—The freighter West Eagle, belonging to the United States Shipping Board and loaded with a cargo of naphtha, kerosene and coal, caught fire recently in the harbor here and will probably be a total loss.

Ottawa.—A temporary setback for the Dominion Government's shipbuilding programme is entailed in the suspension of operations by the Prince Rupert Drydock and Engineering Company, official news of which has been received by the Department of Marine and Fisheries.

Toronto.—It is stated on the authority of the harbor master here that the buoys and aids to navigation will not be lifted until absolutely necessary, as there are a number of steamers still navigating the waters of the bay. The owners of these vessels state that there is plenty of freight offering and they could if weather conditions permitted run all through the winter.

Toronto.—It is understood that the two vessels building at the Dominion Shipbuilding Company's yard when the company went into liquidation, for the Dominion Government, will be finished under an arrangement with the Department of Marine. This was the message given by Mr. Ballantyne to a deputation of Shipbuilders' Union, who waited on the Board of Control with reference to these ships.

Sault Ste. Marie:—The steamer Francis J. Widlar was blown ashore on Whitefish Shoals in a gale of wind, and became a total wreck. No lives were lost, as the Reid Co.'s tug "Iowa," succeeded in reaching the wreck, and removing the crew. A tow barge was lost by foundering during the same gale, and several vessels had a hard time reaching shelter.

St. John's, Nfld.—A new departure will be made in the seal fishing by the introduction of dirigible air ships and trained observers. They will find the seal pack in the early spring, and, having found them, keep in touch with them, advising the seal fleet of their whereabouts. The observer will also be able to advise the skippers as to ice conditions, which will help them in reaching the hunting grounds in the shortest time, and with the least danger.

Kingston.—The tug W. L. Forrest has been sold to James Playfair, of Midland, and will sail round to Port Arthur to work in the harbor there.

Halifax. — The steamer "Canadian Mariner," the largest steel ship ever constructed in the Maritime Provinces, had a successful trial trip. The steamer went sixty miles to sea, and at times achieved a speed of 12.6 knots an hour. The machinery worked perfectly. The "Canadian Mariner" registers 8,100 tons, and was built at the Halifax shipyards for the Canadian Government.

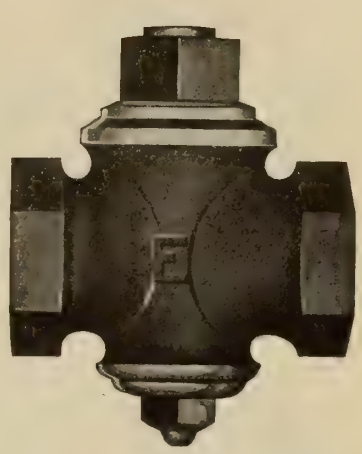
Cleveland:—The end of the navigation season is being forecast by the laying up of the barges of the Pittsburgh Steamship Co. These are being tied up as they reach Lake Erie ports. The steamers of the Company and other big operators will be kept in the ore trade until the end of the month. The ore movement for the season is reckoned to reach a total of 57,000,000 tons.

Sydney.—The Government navigation school will be opened at the beginning of the year, and there are a number of applications already in for the course. It is expected that after the ferry services close down for the winter there will be a number of applicants and there is some talk of making the school a permanent institution as it is in Halifax and St. John.

Sault Ste. Marie.—The Francis J. Widler, which was driven ashore at Pancake Shoals in a recent gale, will in all probability be salved. She had successfully withstood the pounding of the seas during the remainder of the gale that drove her ashore, and it is believed to be not badly damaged below the water line. The captains and owners were planning to undertake the salvage at the earliest opportunity.

Vancouver:—The prospects for increased imports and exports through this port are very good, according to Mr. B. C. Keeley, general manager on the Pacific Coast for the C. G. M. M. The company, he said, would shortly have five ships on the Australian route, and these vessels would all be oil burners. A steamer would shortly sail for India, and the Australian steamers would probably soon be fitted with refrigerated space.

A Vital Part of Any Steam System —A Place for "Empire" Stop Cocks



A-810

The stop cock may be the weak point in your steam system; bolster it up by installing Empire Steam Stop Cocks. They are always dependable and durable, and our rigid factory tests and guarantee fully protect the engineers who recommend their use. They stand for service.

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ONE hundred years before Columbus landed in America, there was established in England a guild of gold and silver smiths who, through pride of craft, established a mark whereby when a housewife bought silverware and saw on it the word "Sterling" she made her purchase with absolute assurance of value received.

Five centuries have passed since that mark was established. To-day it still remains an unerring guide throughout the English-speaking world, and woe betide the man or firm who misuses this mark "Sterling." The police of the world stand back of it.

Only six short years ago there was established on the North American Continent another guild of craftsmen — another body of men with pride of achievement—the guild of Advertisers, Advertising Agents and Publishers.

They, too, adopted a hall mark to designate an honest product in the business in which they were engaged.

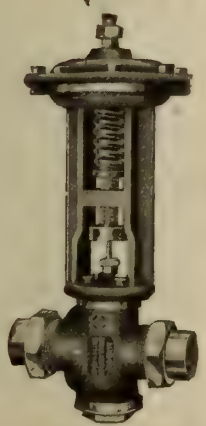
Sentiment, genius or instinct guided the adoption of the three great foundational letters A.B.C. as their insignia. In one respect alone did these two great guilds of craftsmen—separated in birth by over five centuries—differ. One determined the fineness alone, and left the purchaser to measure the weight. The other determined the weight but gave such specific information as would enable the buyer to determine for himself the degree to which that fineness applied to his own particular business.

A.B.C. stands for Audit Bureau of Circulations, and Audit Bureau of Circulations stands for absolute honesty in the preparation and presentation of circulation statements. The advertiser who buys space in a publication whose circulation is audited by the A.B.C. knows exactly what he is getting.

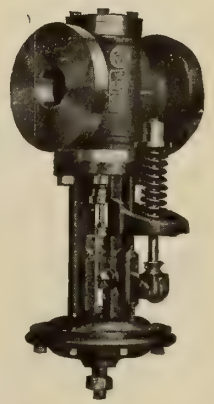
Marine Engineering and all MacLean Publishing Company papers are members of the A.B.C.

—*Quality*
—*Reliability*

MASON



Mason No. 55 Style Pump Pressure Regulator



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Where the service is unusually severe—where you know you must have a pump pressure regulator, steam trap or reducing valve that won't play out, install Mason equipment. **Mason** represents the highest quality in Marine Specialties. They can consistently be depended upon to give long and efficient service.

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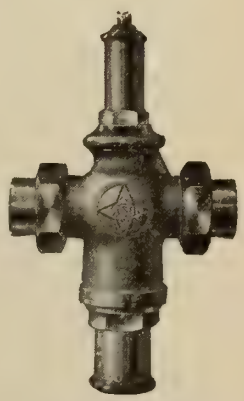

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are adaptable to any type of marine service. We are prepared to make prompt shipments of outfits of any size and will gladly assist in layouts, furnishing blue prints and all necessary data.

A refrigerating machine will cool any number of refrigerators, besides cool water for drinking purposes and manufacture any stipulated quantity of ice. In any service, ice machines improve the run.

Literature, estimates or a personal survey on request.

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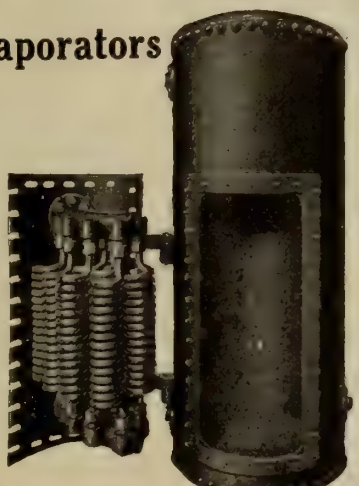

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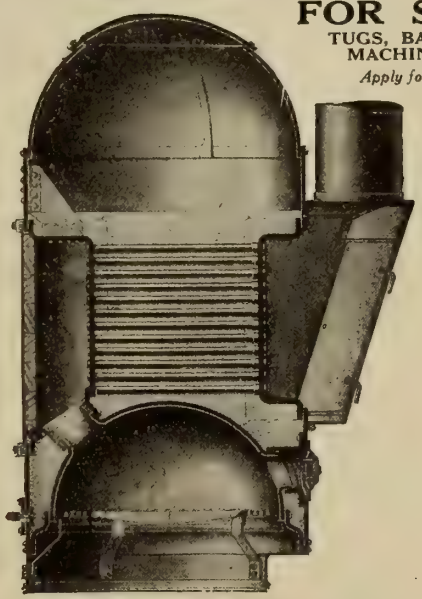

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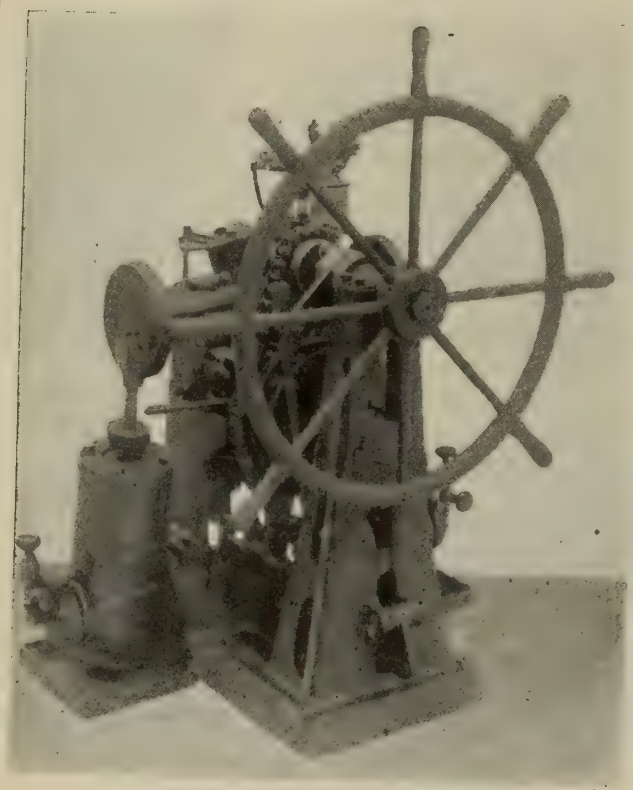
Hanly

Pilot-House Steam Steering Gear



Dependable—Always

The Hanly Pilot House Steam Steering Gear can be depended upon to give efficient service at all times.

The gear is equipped with an automatic closing device which stops it hard to port or hard to starboard. At a slight movement of the hand wheel, the engine is made to stop, start or reverse.

A full description and prices of the dependable Hanly Gear will be sent upon request.

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Electric Welding, Boiler Marine Work a Specialty,
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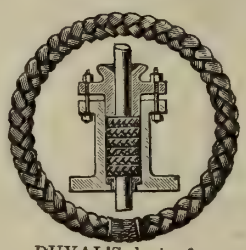

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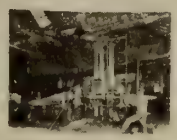

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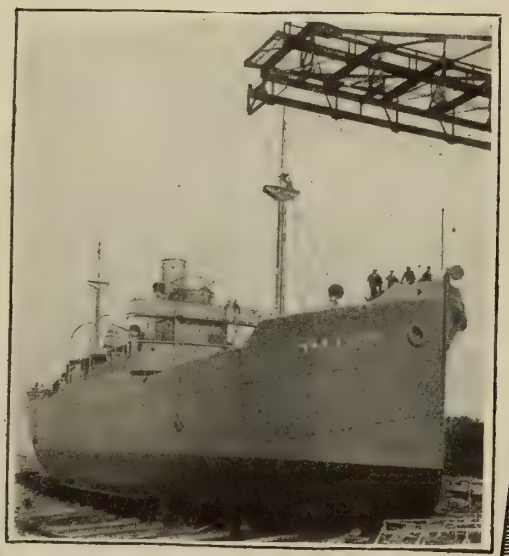

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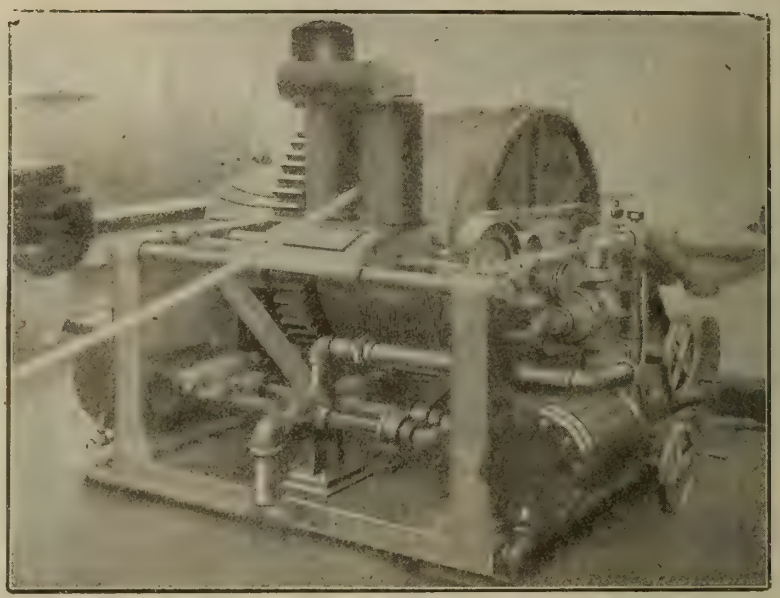

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Less help and better service quickly follow the introduction of this up-to-date Towing Machine. Quickly pays for itself. Permits the use of flexible steel cable instead of the troublesome, old-fashioned manila rope.

Write for full particulars of this and other Corbet Marine Equipment.

The Corbet Foundry & Machine Co., Limited
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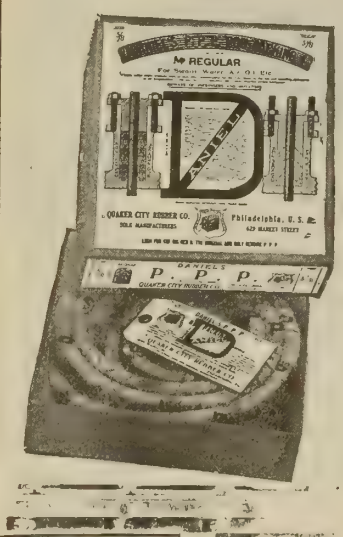

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Many practical tests by experienced engineers under various conditions have clearly demonstrated that P.P.P. is the most economical rod packing to use. Its long life is remarkable, its ability to create a saving in the fuel bill is well known.

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is a booklet that should be in the hands of everyone who has anything to do with rod packing, whether buyer or user.

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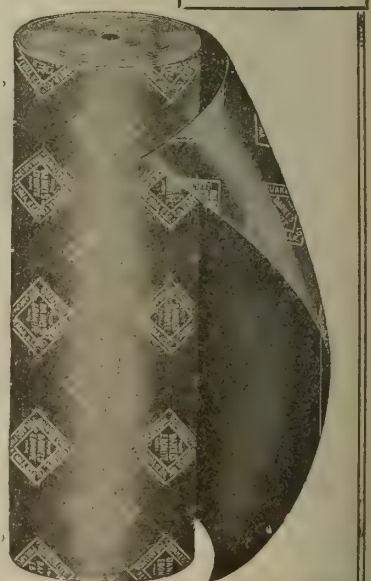
Used exclusively in many of the largest power houses, factories, and machine shops, for high pressures, super-heated steam, hot water, ammonia, oils and acids and all other kinds of joints requiring packing.

EBONITE will hold a vibrating joint absolutely tight, and where there is a varying expansion or contraction of the pipes EBONITE is especially desirable.



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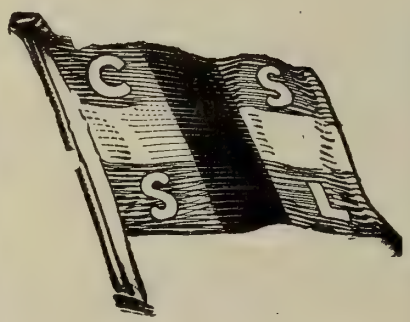

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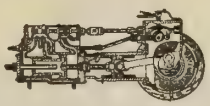

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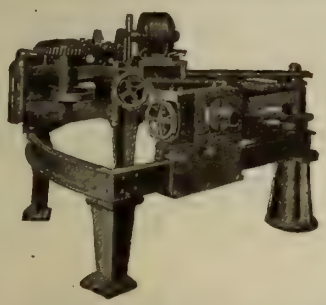

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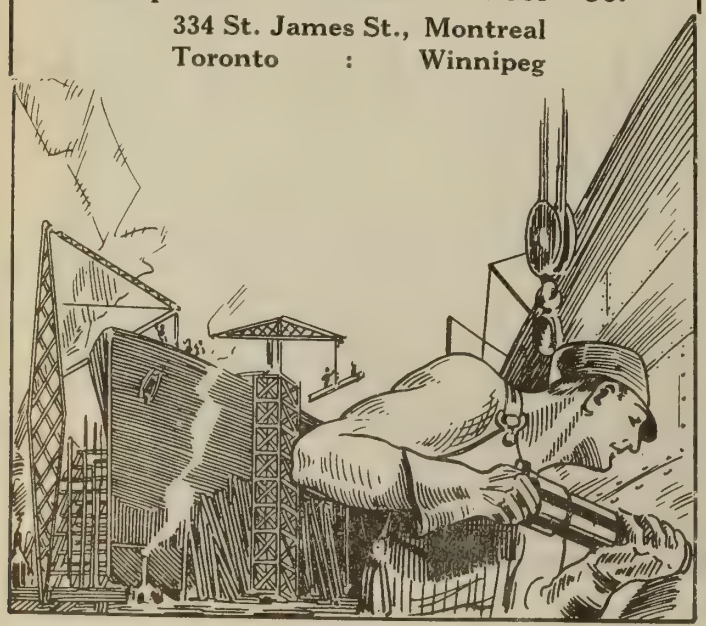

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U.S. Shipping Board
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Canadian Government

and receives the highest classification of the American Bureau of Shipping and of Lloyd's Register of Shipping.

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We also have nearly completed 1—15″&32″ / 24″ Fore and Aft Compound Surface Condensing Marine Engine on which we could give prompt delivery.

We make a specialty of Marine Engines up to 700 Indicated Horse Power; Marine Boilers, Small Freight and Passenger Steamers and Tug Boats and would solicit your inquiries.

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SHIPBUILDERS
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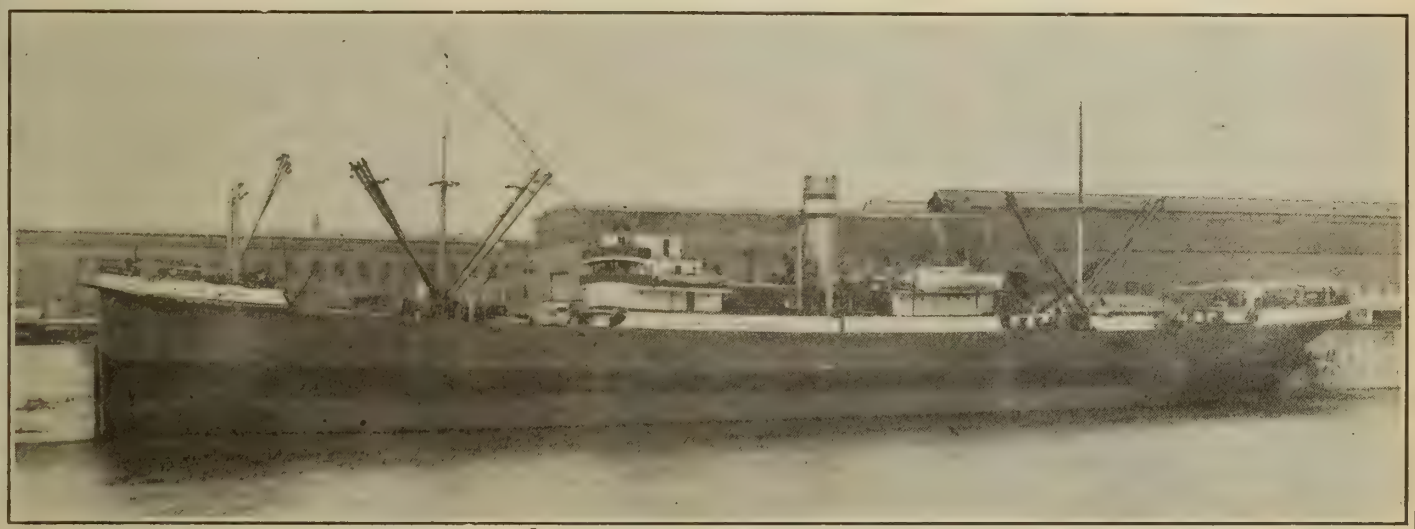

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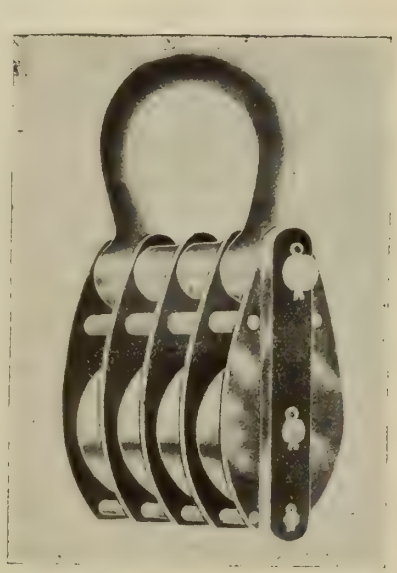

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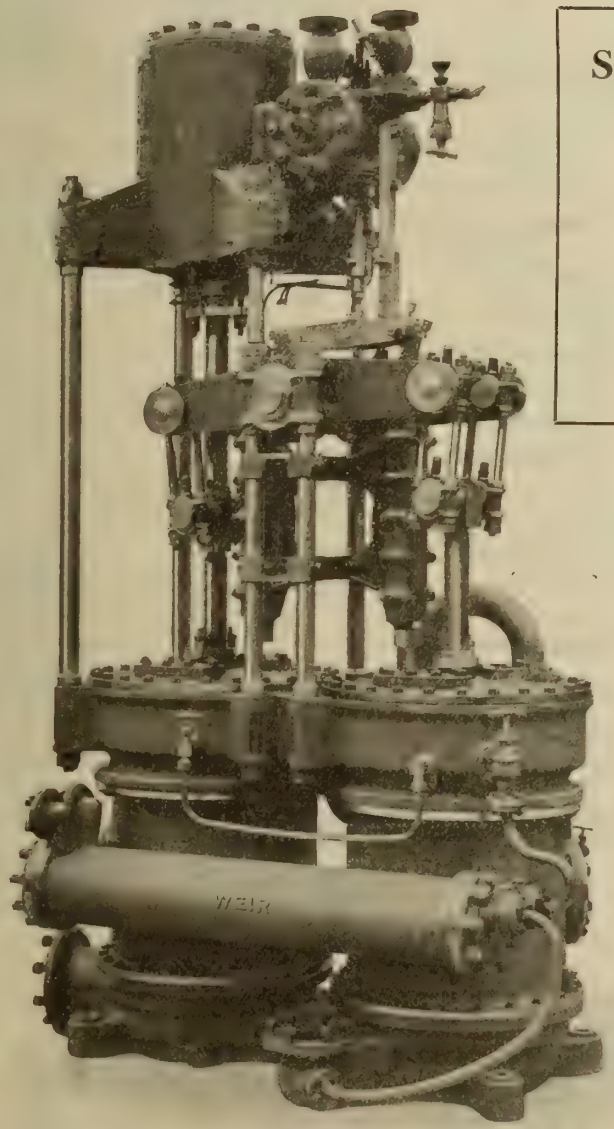

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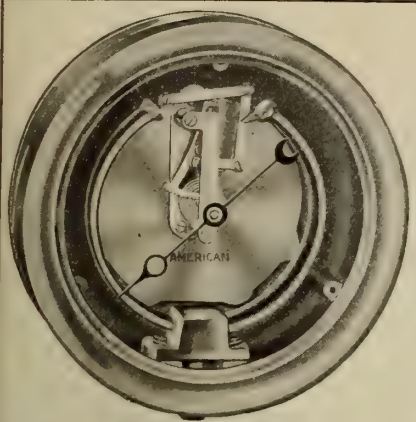

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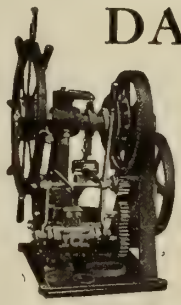

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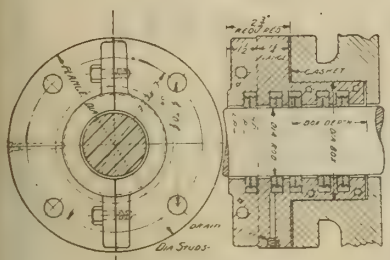

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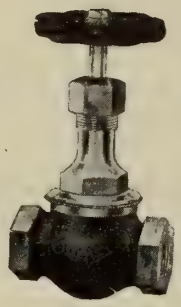

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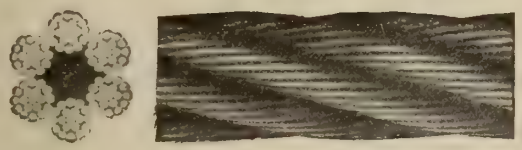

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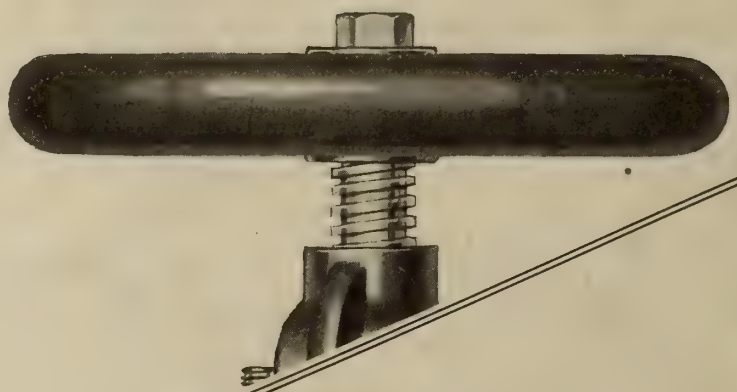

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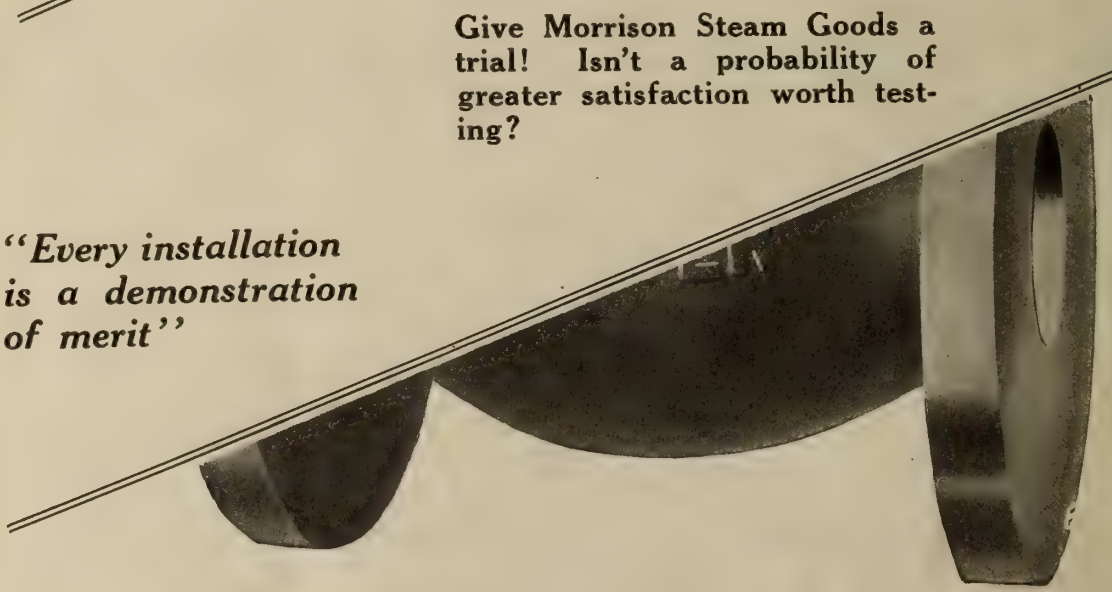

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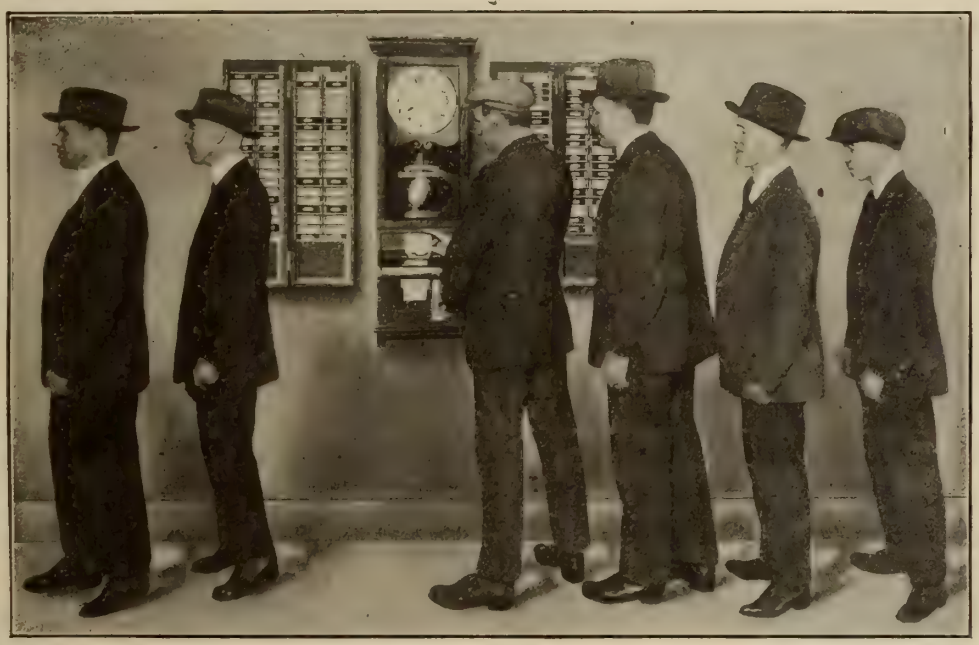

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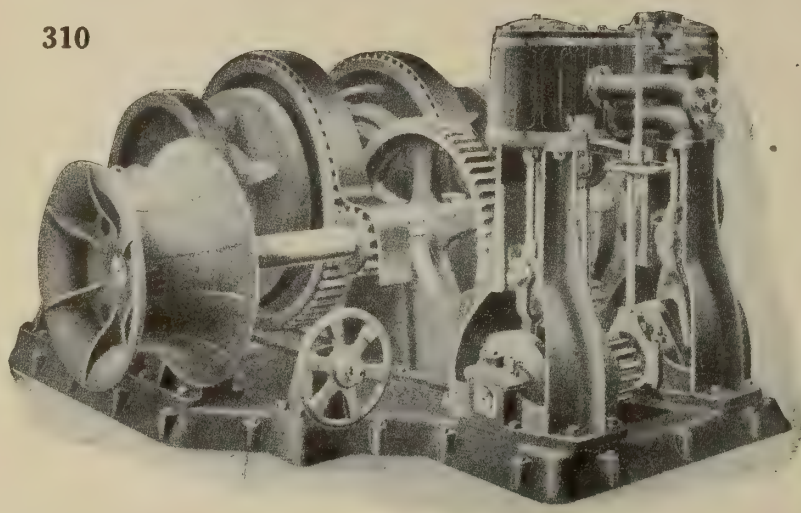

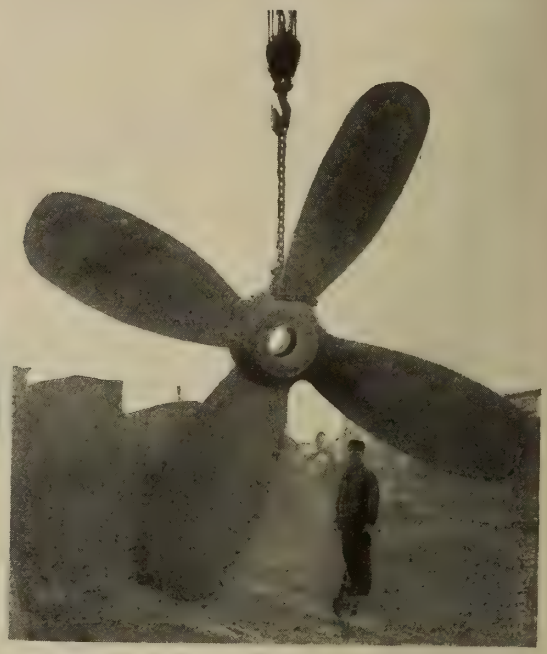

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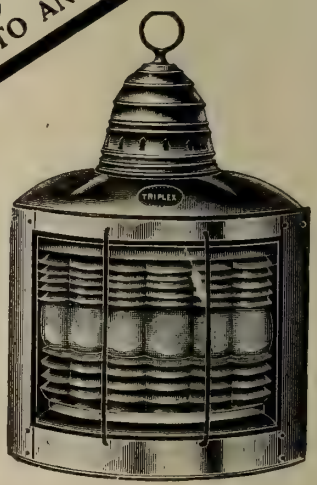

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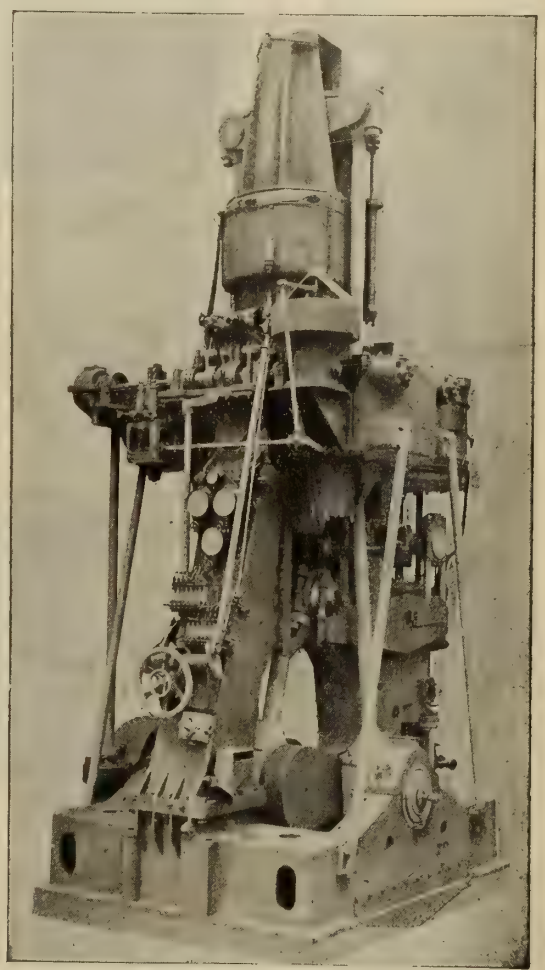

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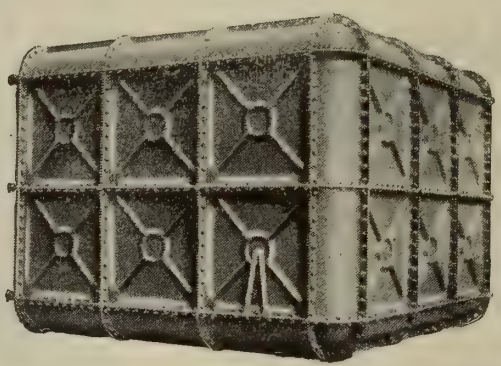

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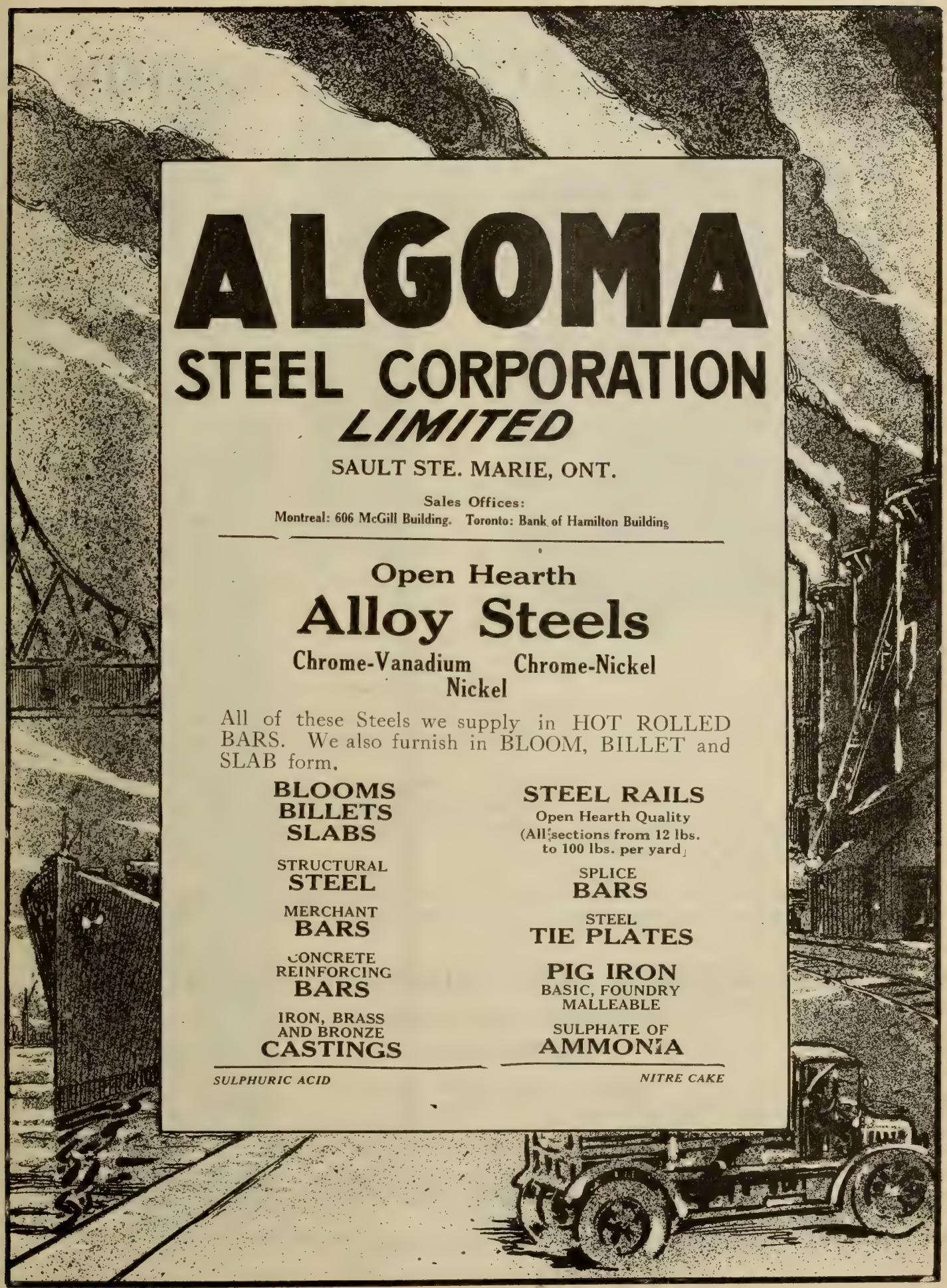

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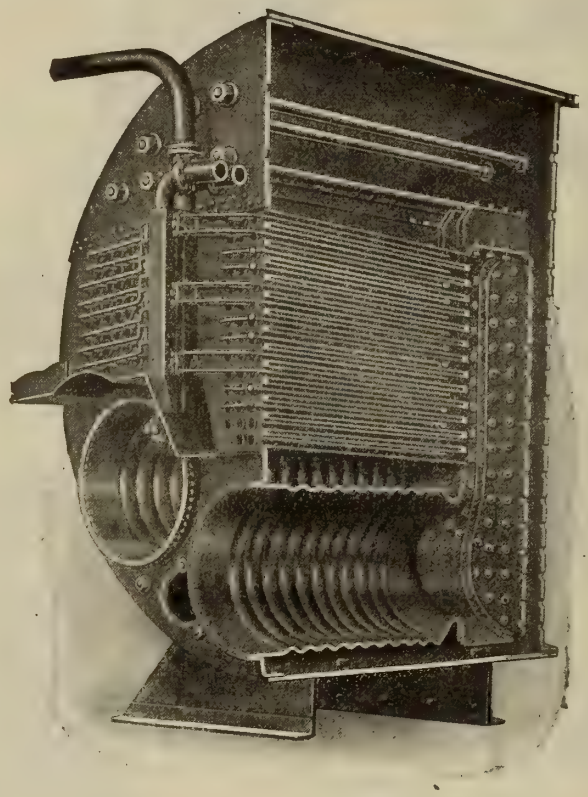

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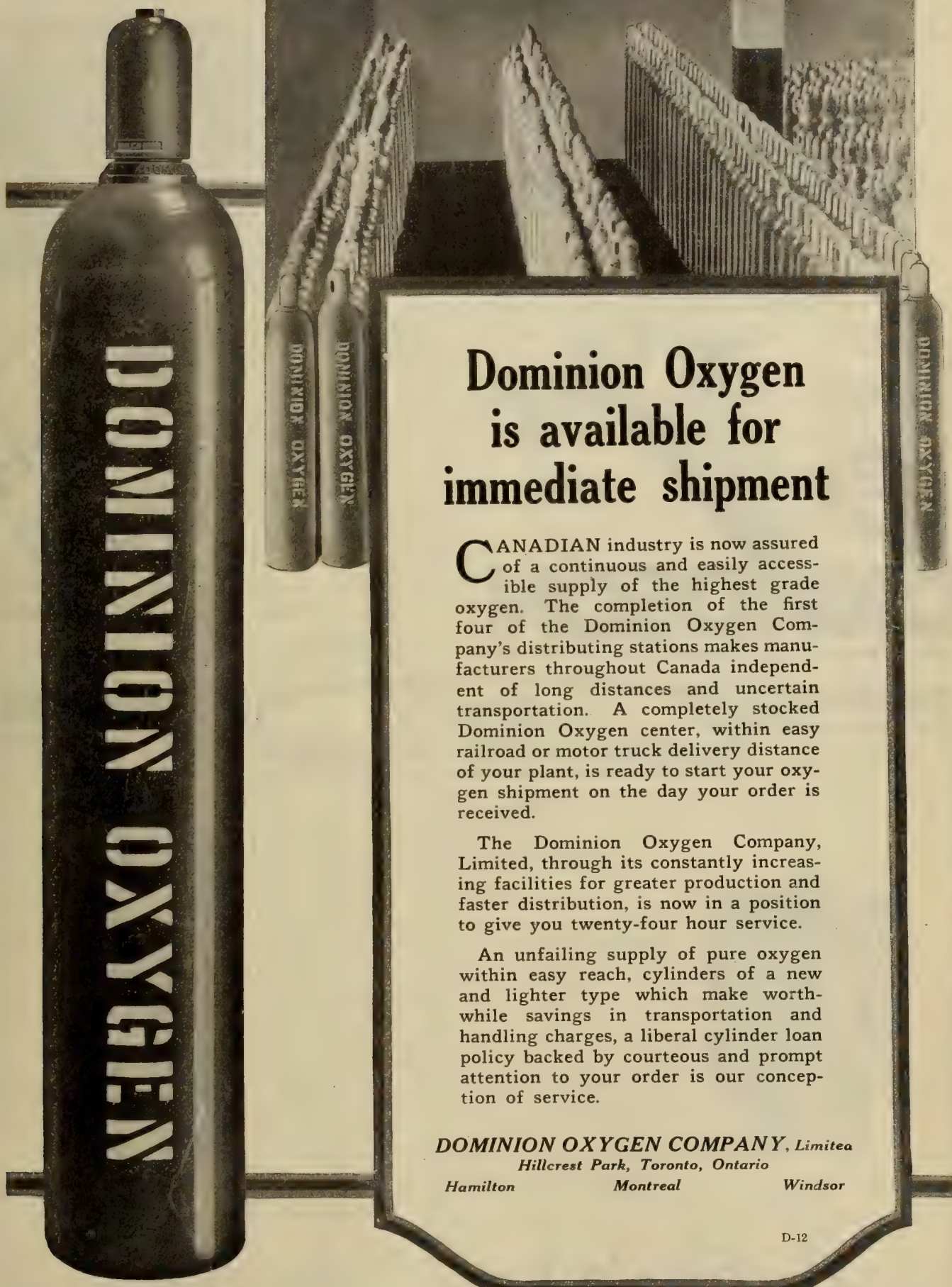

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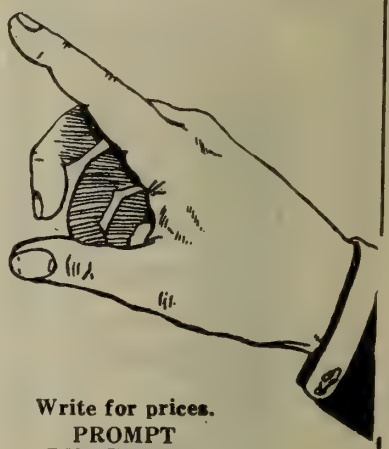

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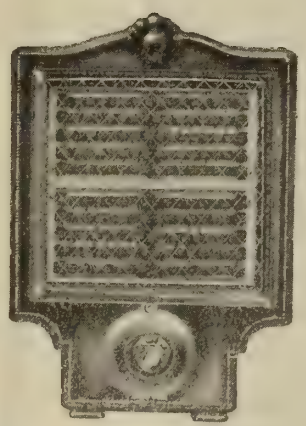

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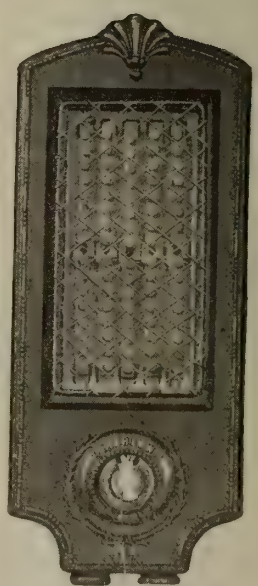

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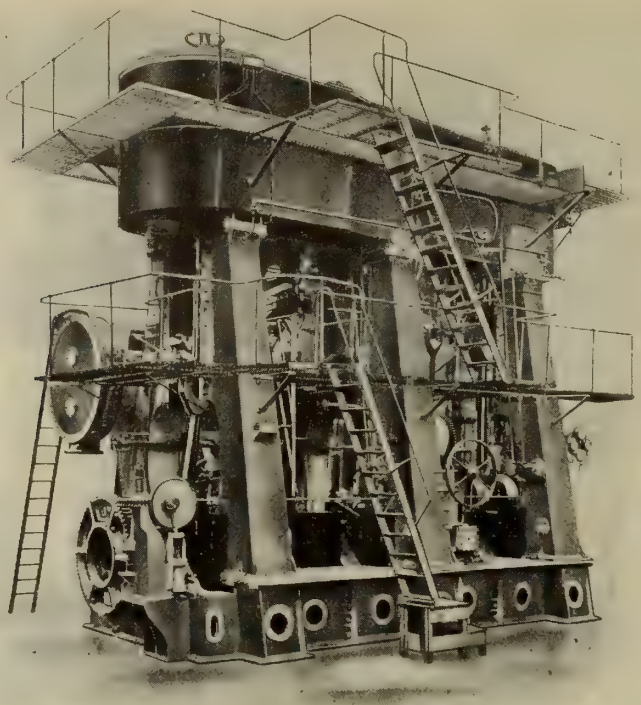

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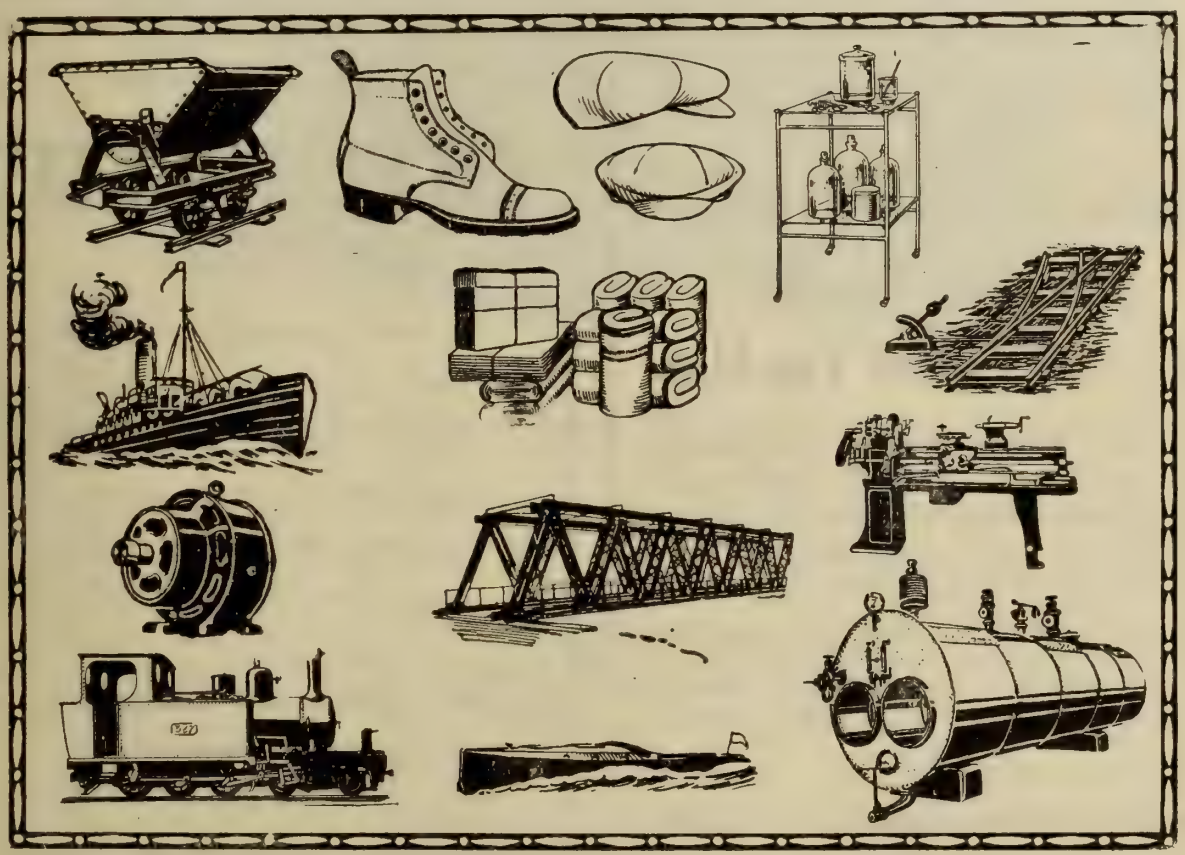

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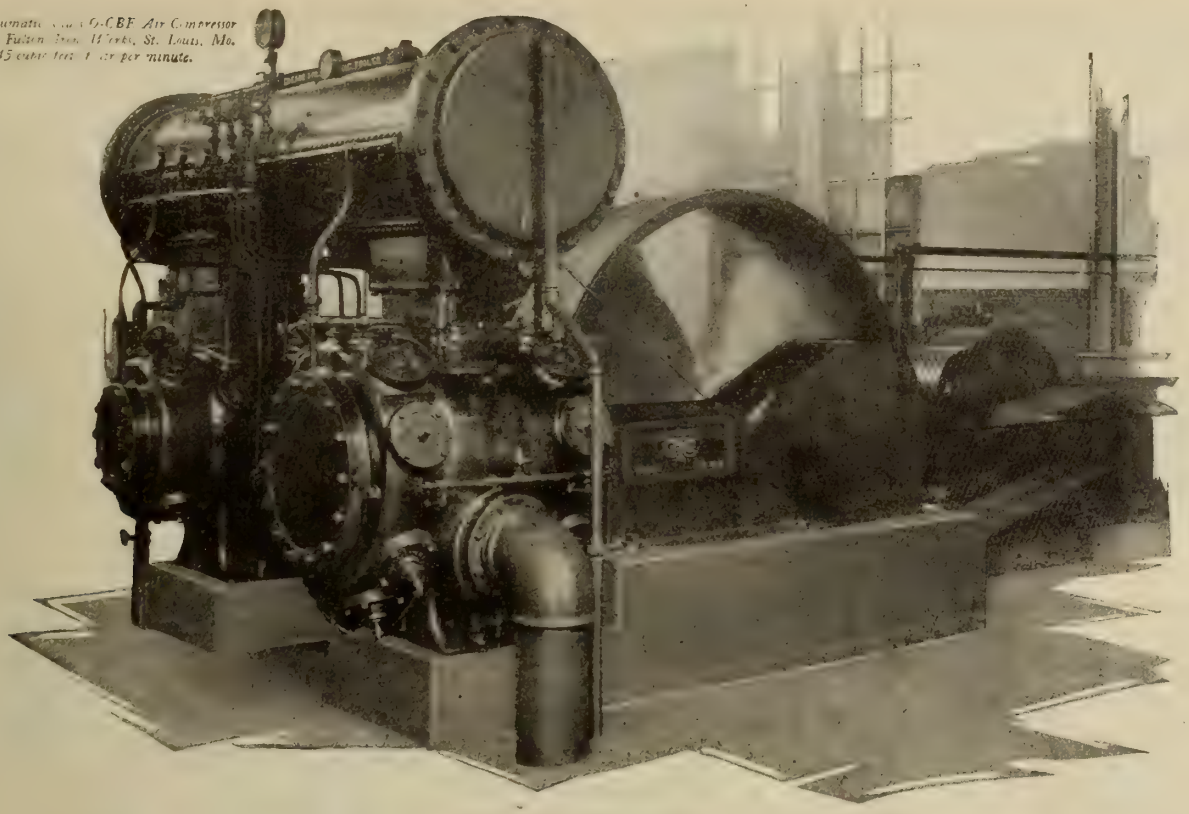

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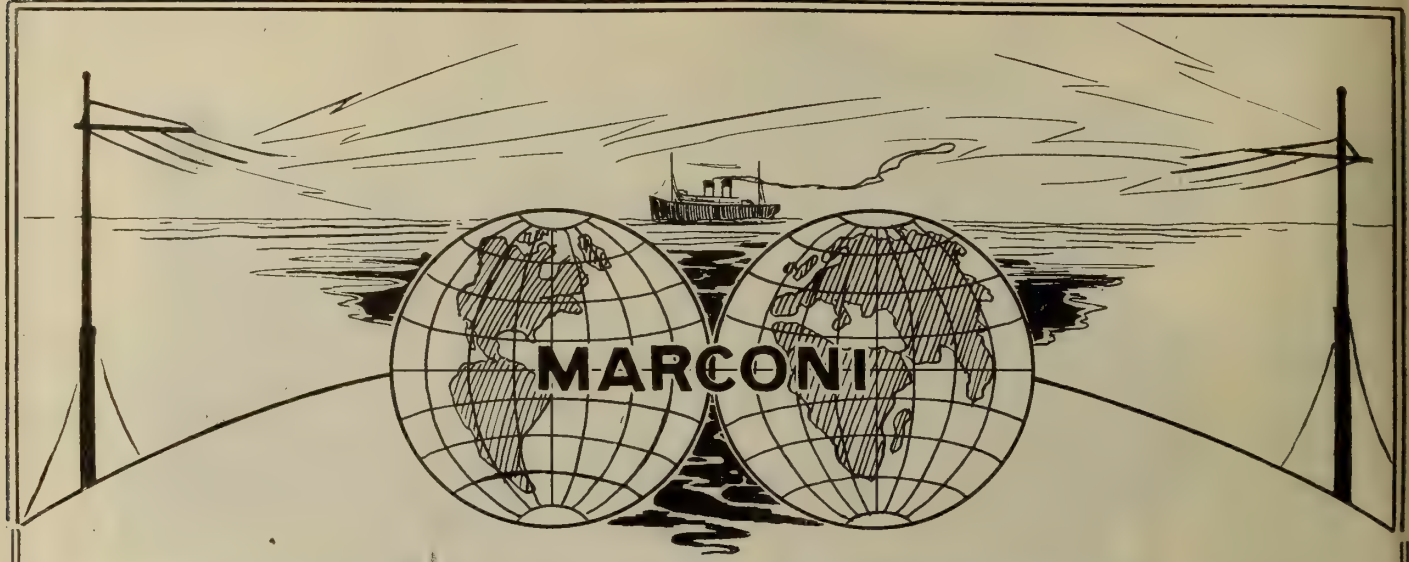

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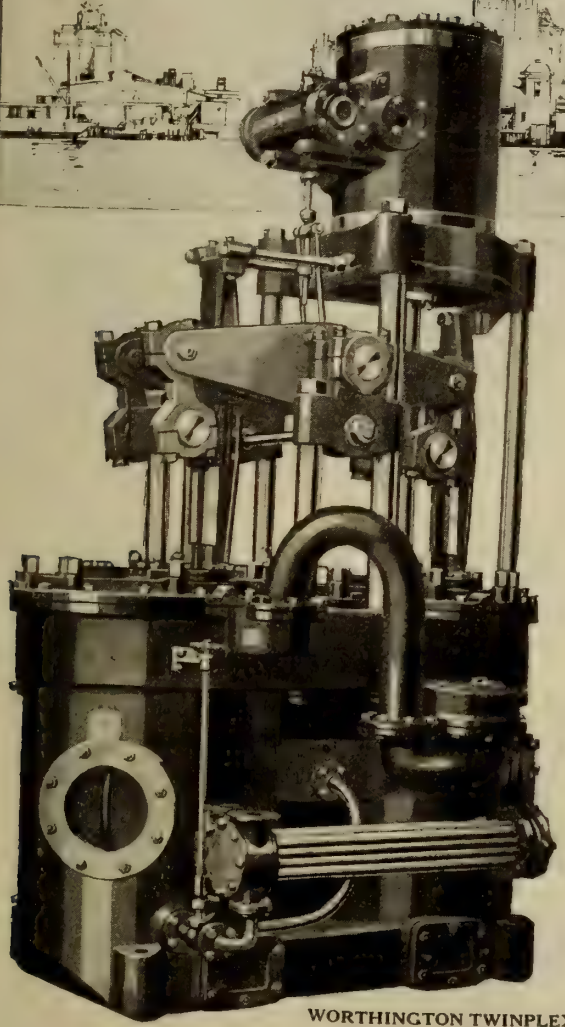

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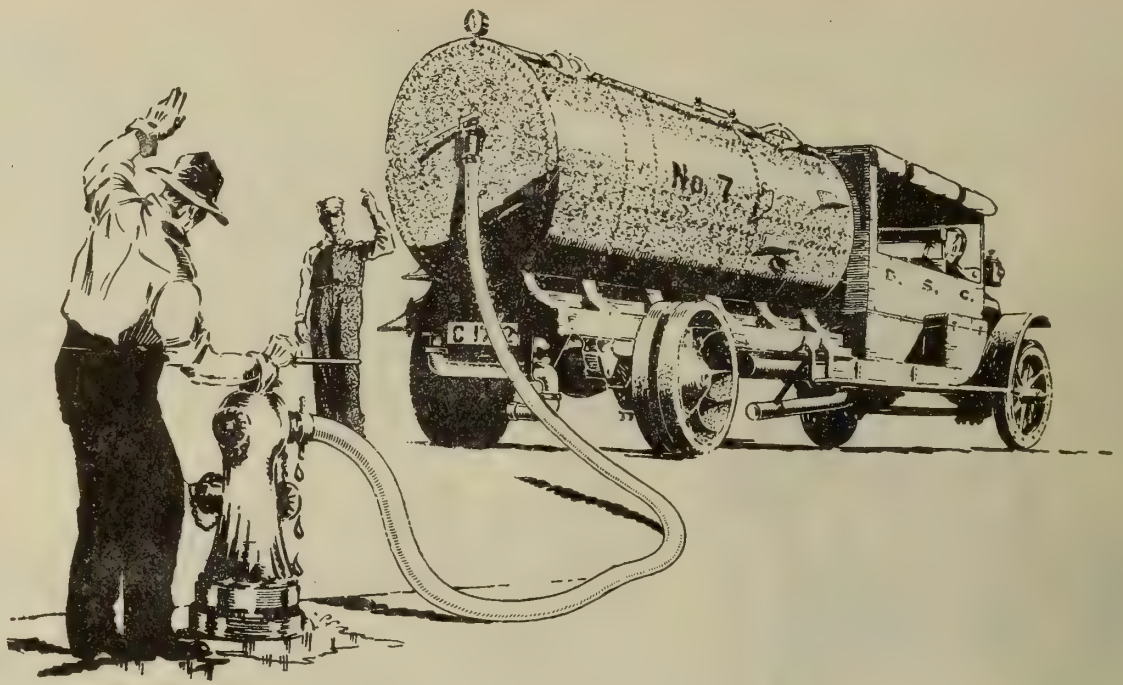

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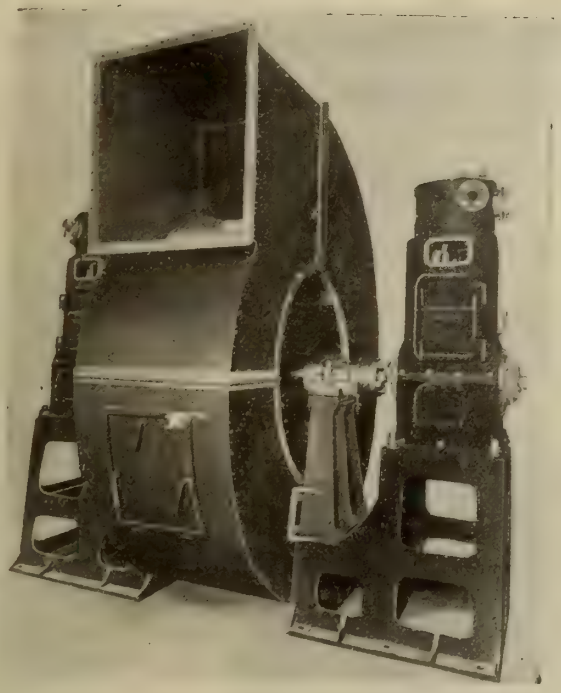

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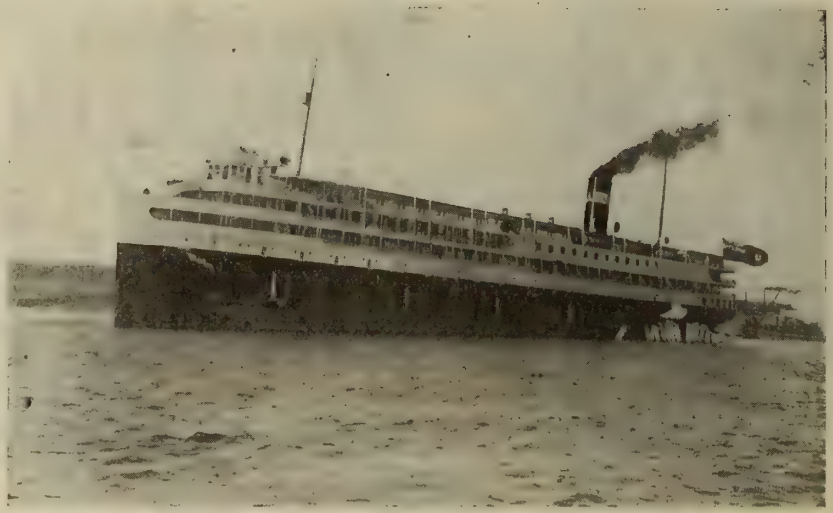

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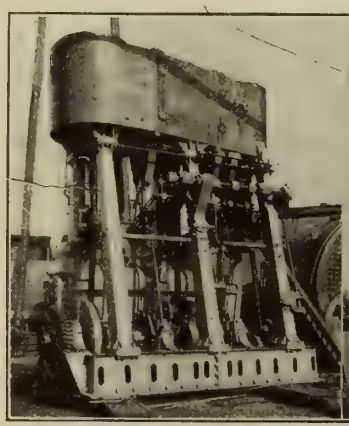

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Vol. X. DECEMBER, 1920 No. 12

Oil Fuel From the Well to the Consumer*

The Stratification and Processes of Distillation of Crude Oil are Explained, and a Number of Applications of Oil Fuel Burners To Furnaces With Natural and Forced Draught are Given.

By J. H. WILLIAMS

NATURE has hidden in the earth and in the waters under the earth many things useful to man, but there are few, if any, more useful to man than oil, and the term "struck oil" has become familiar as an expression for having acquired riches.

Origin.—The origin of petroleum is not known with any certainty, but a widely held theory is that it was formed during the carboniferous periods of the world's history by the decomposition and destructive distillation of the vast marine vegetation and animal organisms then existing, much in the same way that the coal measures were formed from terrestrial vegetation. Formerly much more of the world's suface was covered by water than at present and there were many shallow seas or swamps where the slowly rotting marine growths were deposited with sedimentary sands and calcareous matter of marine organisms, and as ages passed these deposits were covered over and sealed in. Under the effect of heat and pressure through a long period of time these organic deposits were decomposed and formed liquid petroleum and gas, and remained in the porous strata of sand and lime until the present day. It would appear that such deposits should naturally be horizontal, but during the cooling of the earth's surface volcanic movements have occurred, and probably due to contraction, have resulted in wave-like formations or curves presenting the appearance of low rolling hills and valleys. Petroleum is usually found where the earth's movements have not been of a very violent nature.

Referring to Fig. 1 the cap of the curve is termed the "Anticline" and the hollow the "Syncline." The well is usually drilled in the slope of the anticline in order that the greatest amount of oil can be drawn off in the most economical manner. Salt water is nearly always found in petroleum wells and being heavier than oil is found in the lower part of the anticline or in the syncline, while the gas, if there is any, collects under the cap. The pressure of the gas forces the oil up the casing and saves the cost of pumping.

Locating a position for an oil well is not as simple as it may sound, even when the presence of oil is suspected in a district. The most common surface indications are "seepages" or leakage of oil to the surface from its underground source. Seepages are fequently deceptive because the subterranean pool may be a considerable distance horizontally, sometimes miles, from the surface position of the seepage.

In Fig. 1 the strata are shown running parallel to the surface and parallel to each other, it is quite easy to imagine that the strata do not always arrange themselves in such an orderly manner. In the case of a fault as shown by diagram Fig. 2 the oil would probably leak from the oil sand under gas pressure and travel under the overlying impervious strata of clay and limestone until it met a pervious formation through which it could filter up to the surface.

Locating a well is not an exact science but is generally the result of much labor and thought on the part of expert geologists.

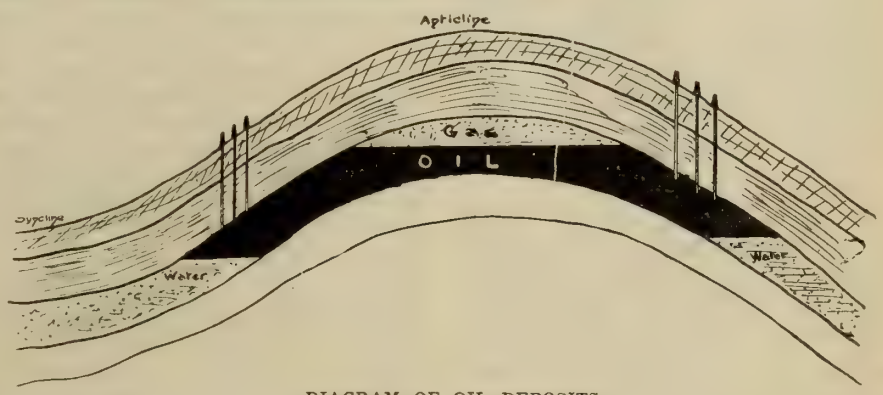
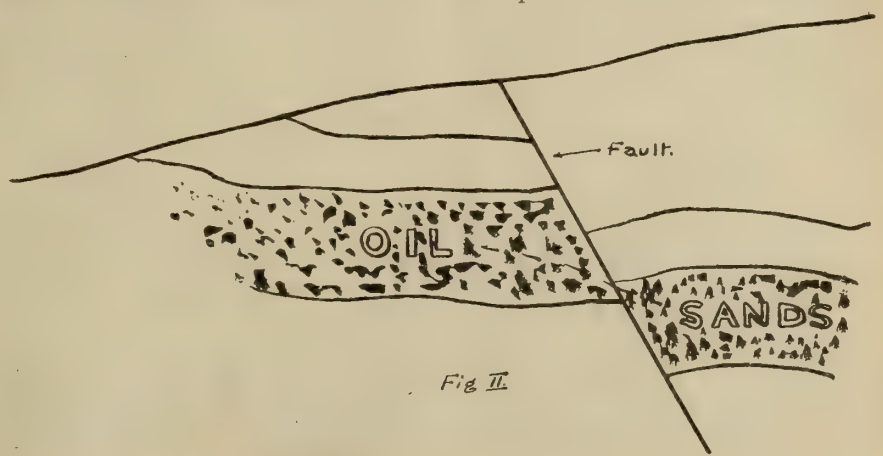


DIAGRAM OF OIL DEPOSITS.

Winning Oil.—Drilling operations. Petroleum wells are drilled in a somewhat similar manner to drilling for water.

The outfit is generally referred to as the "Rig" and the type of "Rig" to be adopted is determined by local conditions and the strata through which the bore passes.



SHOWING A FAULTY STRATA.

*Transactions of the Institute of Marine Engineers.

There are two systems of drilling: (1) The standard or percussion system. (2) The rotary system.

First a hole is dug, and over the hole a derrick is erected about 80 feet in height and 24 feet square at the base. This derrick has to support the well casing and the string of tools. Drilling is more rapid with the rotary system than with the percussion up to about 2,000 feet depth, at which point there is very little difference in the rate. The standard system has some advantages of its own, depending upon the formation passed through, in the hardest formations the well will more nearly approach the vertical. In the standard rig there are two pulleys on the top of the derrick, one carrying the cable with the string of tools, and the other carrying a rope with the bailer. The rope carrying the tools is fixed to one end of a beam or lever called the walking beam, and the other end of the beam is operated by a steam engine. (Before any oil is discovered the boiler is fired by wood cut from the bush around and if the well is not a "dry hole" it is subsequently "oil fired"). This gives the necessary motion to the tools. The drill stem or bit is operated for a certain number of hours, according to the nature of the strata through which the boring is passing when it is taken off to be "dressed" or sharpened, and while this tool is being changed the bailer is connected up and the water and borings made by the drill are pumped out. This operation proceeds night and day.

All wells require to be cased to prevent the sides caving in, and to prevent the infiltration of water. In Mexico casing usually starts with a 14-in. or 12-in. steel pipe and finishes up with a 6-in. or 4-in. pipe. The casing follows the drill, thus while the string of tools works in the casing the point of the drill is always ahead of the casing. The rotary system is mainly used for sinking deep wells through loose or soft formations. The operation consists in rapidly turning a column of pipe at the end of which is a special tool for cutting the formation through which it is passing. To wash out the cuttings, and so leave a clear surface for the cutter to work upon, water is forced through the pipe under such pressure as to cause it to return to the surface on the outside of the pipe. By this means a column of pipe can easily be sunk through beds of sand, gravel or other soft formation which otherwise through their lack of stability would render it very difficult to first drill a hole and then insert the pipe or casing to form the wall of the well as in the percussion system. It takes anything from 60 days to 300 days to drill a well, the rate of drilling being much retarded where there are serious water troubles, or beds of hard rock. Wells vary in depth from 500 ft. to 4,000 ft., generally the deeper wells produce the lighter gravity oils. The oil bearing strata or producing sands vary from 200 ft. to 500 ft. in depth.

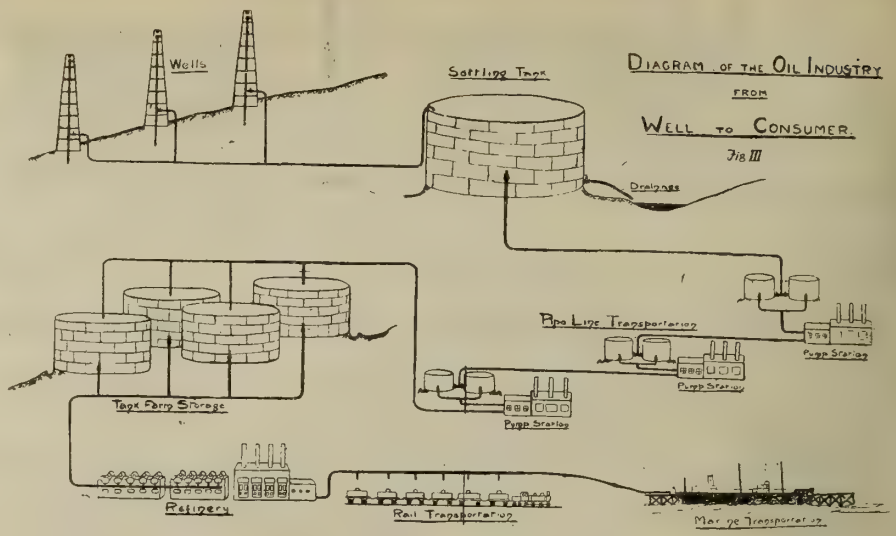


DIAGRAM OF THE OIL INDUSTRY FROM WELL TO CONSUMER. Fig III

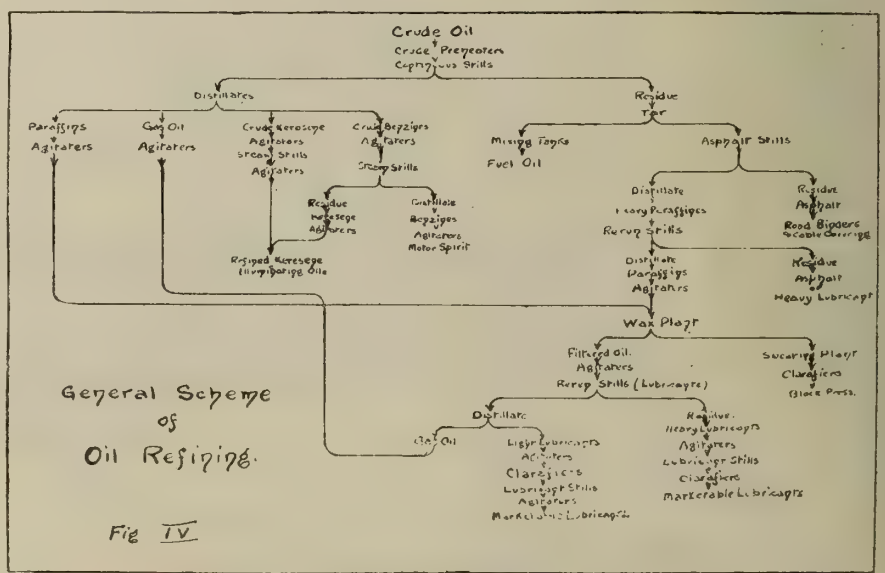
FROM WELL TO CONSUMER.

Some years ago particulars were given in an American publication of the cost of completing an oil well in California. It was then stated to be anywhere from £2,000 to £20,000, depending, of course, upon the strata through which the well is drilled. In a proved oil country the estimate was £2 to £3 per foot. When exploring new fields, of course, the cost of every "dry hole" must be added to the cost of the producing wells; from this it will be easy to see why oil is not exactly given away, especially when for every producing well two "dry holes" are bored, and it has been stated that for all the producing wells about 70 per cent. yield less than 100 barrels per day (about 14 tons).

Storage.—The crude oil when first brought to the surface is found to contain water and dirt, generally sand, and is of a dark brown or black color, and is very rarely a light color or transparent. From the well the oil is run or pumped into a preliminary storage tank, where the sand and water are allowed to settle out before the oil is transported to the refinery. Fig. 3 illustrates diagrammatically the progress of the oil from well to consumer.

Light oils are refined as soon as possible to avoid evaporation of the volatile constituents. Heavy oils can be stored for a considerable time without great loss. Steel tanks are usually employed for storage of oil, but heavy oils can be stored in clay or earth reservoirs covered with a wooden roof. This is a very cheap method of storage, but is not highly recommended because the walls of the reservoir have been known to be washed away when a heavy rainfall occurred.

Transportation. Land and Ocean.—The value of oil depends upon its availability. Inaccessible fields require pipe lines of great length. The location for a pipe line is determined by the topography of the district through which the line passes, in much the same way as a railway line; it is obviously not advisable to carry a pipe line over a mountain or through a lake if it can be avoided. Main pipe lines are generally 8 in. diameter, the tendency being to increase the diameter for the heavier and more viscous oils.



OPERATION CHART.

The 8-in. pipe weighs 28 lbs. per foot, and has a cubic capacity of 47 tons per mile. The principal factors in transportation of oil, either by pipe line or ship, are its physical characteristics as

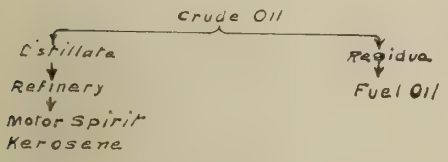
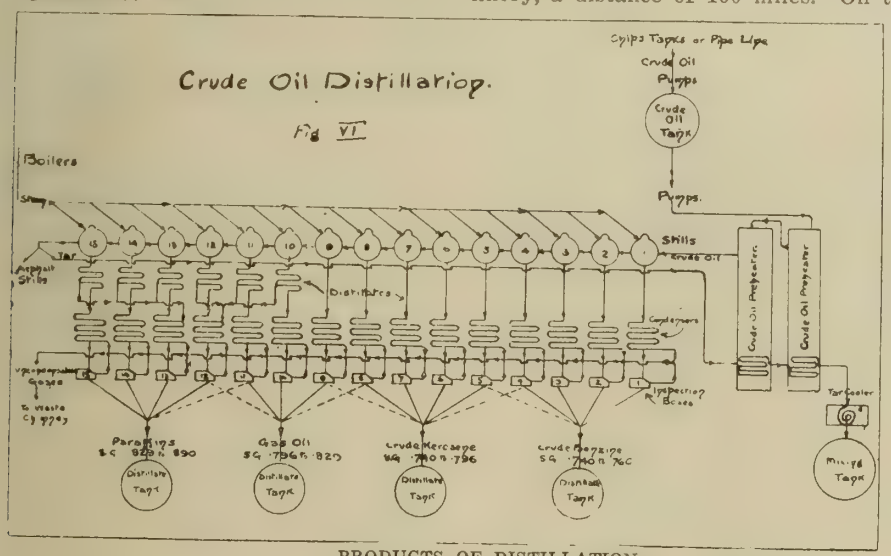


FIG. 5.

regards gravity and viscosity (otherwise its weight and resistance to pumping). The method adopted to overcome the difficulty is to heat the oil to a temperature of about 120 degs. Fah. depending upon the nature of the oil.* High temperatures cause gasification, and give trouble at the pumps, the heating therefore should be carried out on the delivery side of the pump. The capacity of a pipe line is determined by the working pressure at the pumps, the viscosity of the oil (which is due to composition and temperature), and the climatic conditions (temperature and rainfall) and the distance between the pump stations. The capacity of a pipe for oil increases faster than the square of the diameter because the friction decreases with increase of size. A pipe line consists of: 1, Field station; 2, Intermediate stations. 3, Terminal station.

The field station consists of a large number of storage tanks, two or more horizontal duplex pumps, with the necessary boilers, condensers, feed and circulating pumps, electric lighting and exhaust steam heaters for heating the oil preparatory to pumping it to the first of what we will call intermediate stations. The intermediate stations are very much like the field stations, but there is less equipment, only two storage tanks being necessary and they are usually of smaller capacity than on the field or terminal stations. While one tank is receiving the oil from the preceding station, the oil is being pumped from the second tank on to the following station on the line. The terminal station consists of from 20 to 50 storage tanks and the pumps are constructed for a lower pressure, the duty being to deliver the oil into the refinery or to tank steamers for export. The pumps are duplex, triple or compound, depending upon the supply of fresh water available at the station, if good boiler water is not available triple expansion pumps are installed with ample evaporators.

Through an 8-in. line, 32 miles long, from Potrero to Tuxpam, 5,000 tons per day are pumped. There is one field station, two intermediate stations, and the receiving station at Tuxpam. The latter is situated on the coast of the Gulf of Mexico at the mouth of the Tuxpam River, but as there are only five feet of water on the bar the ships lie one mile off the shore and pipe lines are laid on the sea bed with a flexible hose at the sea end, and here the ships are loaded without entering port. Another 8-in. pipe line runs from Potrero to Tampico Refinery, a distance of 100 miles. On this line there are 8 pump stations, and 3,500 tons per day are pumped to the refinery at a pressure of 600 to 800 lbs. per square inch. We have now brought the oil to the refinery.



PRODUCTS OF DISTILLATION

Refining.—The question is frequently asked, "What is petroleum?" The chemist will tell you that it is saturated hydrocarbons and then we are not much wiser. So far the chemist has only touched the fringe of the subject, there is every probability that in the future as many products will be obtained from oil as are now produced from coal. Crude petroleum is a mixture of hydrocarbons in variable proportions with small quantities of oxygen, nitrogen, and sulphur present as impurities. Except on the oil fields, and at the pump stations, where no fuel oil is available, crude oil is very seldom used as fuel, the crude oil is always treated or refined and made into marketable products. Most crude oil as obtained from the wells are unsuitable for fuel. The object of the refiner is to subdivide the crude oil into fractions suitable for the different uses to which they are to be put.

At the present day the demands of trade call for principally:

(a) Benzines for motor fuel, cleaning and manufacturing.

(b) Kerosene (frequently called paraffin) for illuminating; also used for motor fuel.

(c) Lubricants (lubricating oil is one of the most valuable of petroleum products).

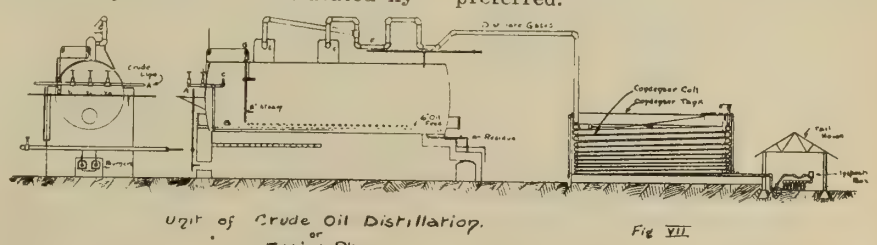
(d) Fuel oil (about 40 per cent. of all crude produced is used as fuel.)

Refineries may be roughly divided into two classes:—

First.—Refineries which treat the whole of the products obtainable from the oil by distillation, see diagram Fig. 4.

Second.—Topping plants which treat the oil with the object of obtaining only a high grade distillate (a) and (b) and a residue (c) and (d) for fuel oil, diagram Fig. 5.

In a complete refinery treating the whole of the products the crude oil is treated in a series of stills, the process is shown diagrammatically in Fig. 6, where the gasoline or benzine, kerosene, and gas oils leave the stills as a distillate, and the residue is a heavy tar or fuel oil. The benzines are further refined in steam stills. The kerosenes are also sometimes redistilled in the steam stills if a high grade produce is required, and they are treated in vertical tanks called "Agitators," where they are made "water white" by agitation with sulphuric acid and caustic soda. The residue is a heavy tar oil which can be used straight as fuel if facilities for heating to the proper temperature are available. In the Mexican Eagle Oil Refineries oil of a gravity S.G. 1.04 is used as fuel. On board ship fuel of a lighter gravity is preferred.



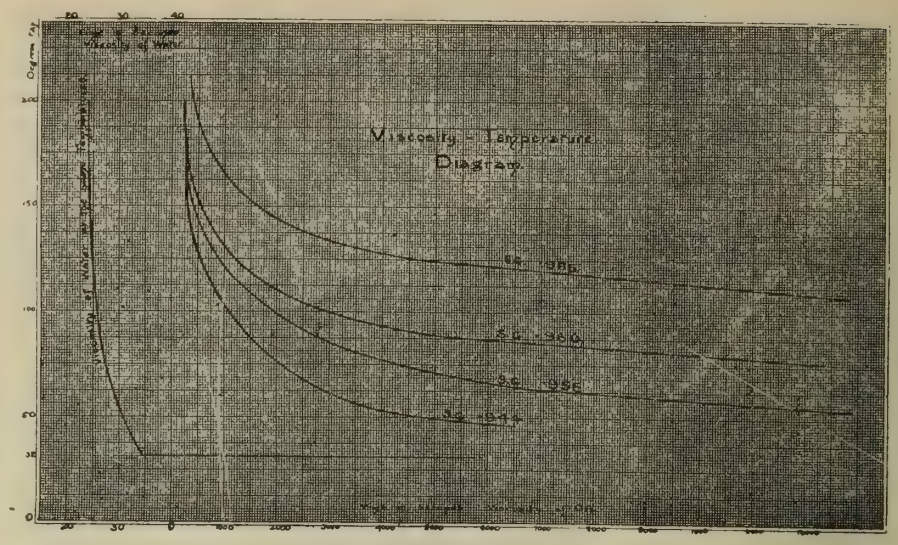
A TYPICAL UNIT.

The crude oil is pumped from the storage tank through the forewarmer to the continuous stills. The process is continuous, i.e., the crude oil enters No. 1 still, then passes on to No. 2 and so on until

*See diagram, Fig. 8.

it leaves the last still as a residue. In each still a fraction of the oil is distilled off, passes over as gas into the condenser coils where it is cooled by the surrounding water and leaves the coil as a liquid, this liquid passes into what is known as a "Tail House"; here are a number of inspection boxes (one for each still), with glass sides where the quality of the distillate coming over is observed and its gravity tested frequently. The tail house is a kind of "Junction," where the distillates are directed to their respective tanks according to their quality.

In the diagram Fig. 6 stills 1 to 4 are shown as distilling off petroleum spirit, 5 to 8 kerosene or illuminating oil, 9 to 11 gas oils, 12 to 15 heavy gas oils or heavy paraffins. If No. 4 be heavily fired it might easily happen that the distillate would have to be directed to the kerosene tank, also if 4 and 5 be lightly fired then the liquid at No. 5 "look box" would be diverted to the spirit tank instead of the kerosene tank. The crude oil left the storage tank at atmospheric temperature, and the residue finally leaves the last still at a temperature of 600 degrees Fah. The continuous stills are in appearance much like Lancashire boilers, some being "through" fired and others externally fired, they are all fired by oil fuel of the heaviest gravity. The fractions we have now obtained are still further refined. The crude spirit is gently heated in a steam still (which is a cylindrical tank with a steam coil) and the distillates are known as "aviation spirit," "motor spirits" of several qualities, and cleaning spirit, the residue, if there is any, will be kerosene. The kerosenes are treated in agitators with sulphuric acid and caustic soda, where all trace of the tar is removed and they are then ready for market. The gas oil requires no special treatment, it is used to enrich town gas, is mixed with heavy residues to make fuel oils, and is used as fuel in Diesel engines. The heavy paraffins, so called because they are heavily charged with paraffin wax, are an important fraction, because when the wax has been removed lubricating oils are obtained. The extraction of wax is an expensive process, but when ready for market it is a valuable product. The paraffin oil is chilled to a temperature of 30 degrees to 32 degrees Fah. when the wax crystallizes, and on being pumped through a filter press the wax crystals are left on the canvas filtering medium and the oil passes out free of wax, ready to be treated in the lubricating oil stills. The lubricating oil stills are oil fired, the distillate is gas oil, and the residue lubricants. The wax requires some further treatment before it is ready for market, the crude wax is rather soft and of a yellow color, but the finished product is hard and white. Lubricants also require further treatment, marine engine oil for instance requires an admixture of vegetable oil, because pure mineral oil will not saponify. You cannot obtain a lather from pure mineral oil



VISCOSITY TEMPERATURE DIAGRAM.

and water. If you have an oil that will not lather freely with a slight admixture of water, leakage from glands of reciprocating engines will wash away the oil from the bearings. In the case of turbine engines the lubricant must not be allowed to emulsify, therefore only pure mineral oil must be used for turbines.

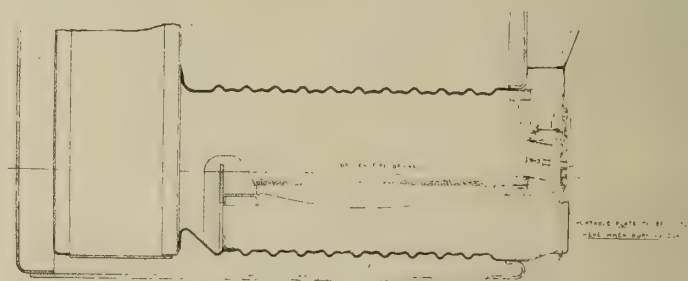
So far we have followed the distillate through the refinery, but the tar oil which left the continuous stills as a residue is capable of further treatment. That portion of the tar oil which is not made into fuel oil is pumped to the asphalt stills, where the distillate is a heavy paraffin which is treated for extraction of wax and lubricants, and the residue is asphalt, the latter being largely used for road making and cable construction. In these stills the tar enters at 450 degrees and the asphalt leaves at 750 degrees to 800 degrees Fah. according to the grade of asphalt made.

A topping plant is the simplest form of refining, it is sometimes adopted where there is a big demand for fuel oil. The light fractions are extracted by distillation and then transported to a refinery, where they can be treated and made into marketable products. The residue, as it contains all the gas oil, makes an excellent fuel of low viscosity and high calorific value. Fig. 5 represents a topping plant.

Ships.—From the refinery the oil is shipped by pipe line, tank wagons, and tank steamers to consumers in all parts of the world.

Pipe lines we have already discussed, tank wagons need no description, and tank steamers are well known to all marine engineers; they are steel boxes divided into compartments, with an engine and funnel at the after end. This appears still to be the view of many people. They are the pariahs of the shipping world when in port, and the most comfortable ships at sea.

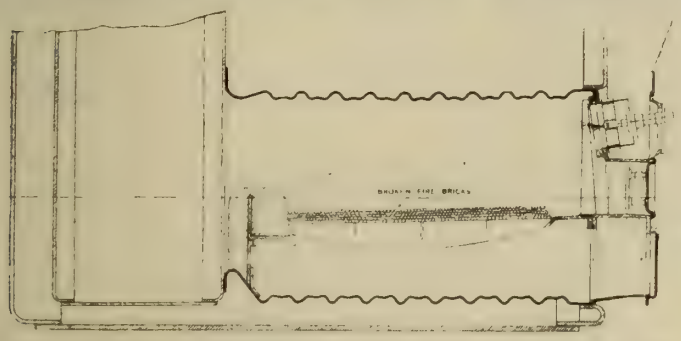
The tanker is to-day one of the most efficient ships afloat. She requires no stevedores for loading or discharging, and is capable of discharging a full cargo in less than 24 hours, the time depending upon the class of oil. The San Fernando of the Eagle Oil Transport Company is 18,000 tons d.w. capacity, and the cargo can be discharged in 18 hours under favorable conditions. The accommodation for officers and crew is luxurious compared with only a few years ago. There is accommodation for 12 passengers. Every ship in the fleet is fitted with refrigerating plant for fresh provisions, so that "salt horse" and "Harriet Lane" are almost unknown to the modern tanker. The only drawback from the officers' point of view is the short stay in port, one vessel recently made a return voyage to the Gulf of Mexico in 40 days, 10,000 miles steaming with 48 hours loading (from time of entering to leaving port).



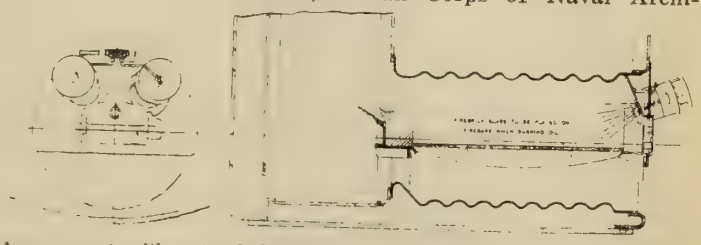
Furnace adapted for either coal or oil, Howden's forced draught. Can be changed over by merely moving broken brick and air directors or vice versa.

We have now brought the oil to the

consumer and endeavored to show something of the nature of the stuff; it may be in order to add a few remarks regarding the handling of fuel aboard ship. It has already been remarked that 40 per cent. of all oil produced is used as fuel, and the possibilities of increased oil production in Mexico are very great, at the same time the demand for oil is increasing enormously. The superiority of liquid fuel over coal is now unchallenged and the question of its adoption is simply a matter of supply and the price at which it can be purchased. It has been said that oil won the war, and it may well be true, for the Allies controlled about 90 per cent. of the world's total production. Oil is a natural fuel for ships compared with coal, and it is now cheaper, easier to handle, and more efficient to use. Three oil fired ships will yield the same efficiency as four ships of the same tonnage burning coal. Oil with a flash point above 150 degrees Fah. is safer than coal, oil is not liable to spontaneous ignition, but if heated beyond its flash point it gives off gas that will ignite. The danger from fire is small and not greater than in the case of coal. In nearly every case of a fire in the stokehold of ships burning oil that has come to the notice of the author the cause was the leakage of hot oil from the burner or pipe at the furnace front, the usual cause is from an unlighted burner where the valve is left open and the oil runs unseen from the furnace into the bilge, and later when the burner is lighted the fire occurs. The real cause is pure carelessness.



Boiler with Howden's Forced Draught, furnace front being made to burn oil with firebars in place. Can burn coal or oil, or both together. Change from coal to oil made by covering bars with broken brick.



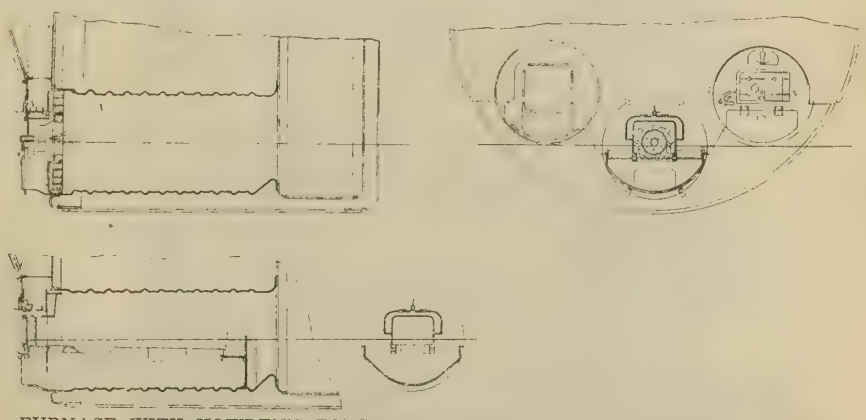
Arrangement with natural draught to burn coal or oil or both. When using oil only bars are covered with slabs.

Fuel Oil Installation. — Successful burning depends as much on the condition in which the oil is delivered to the burner as upon the type of burner. There are many fuel oil burning "systems" on the market, all more or less good. It is an axiom that the most simple installation is the most efficient, other things being equal. The first part of the installation is the bunker. The ordinary double bottom tank will carry oil satisfactorily, but they are not recommended in the case of new vessels where it is possible to have specially constructed bunker tanks owing to the danger of contamination of the fuel with water. The presence of the latter is a distinct disadvantage; besides lowering the heating value it may, in the case of heavy fuels, cause priming in the supply tank, and steam pockets in the heaters and fuel pipes to the burners. Where fuel oil is carried in double bottoms, settling tanks are necessary, where the water can be drained off. Two tanks are necessary, one being in use for separating the water, and the other acting as supply tank for the fuel pump. A steam coil is required in each tank, even if the oil is free from water, to maintain the temperature at about 80 degrees to 90 degrees Fah. to make the flow of oil to the pump easy. Strainers should always be fitted on the suction side of the pump. The fuel pump takes the oil from the supply tank through the suction strainer and delivers it through one or more heaters to the burners. The fuel pump should operate at a low piston speed, have a long stroke, and all clearances and spaces where gas pockets can form should be reduced to a minimum, the suction lift should be as low as possible. The steam driven reciprocating pump has so far held the field, but a rotary pump that would stand high pressure and give a steady delivery pressure would be ideal; there are, however, plenty of drawbacks to all the rotary pumps at present on the market. In burning fuel oils the viscosity of the oil plays an important part because success depends on the pulverization of the oil into sufficiently fine particles to ensure efficient mixing with the air admitted to the furnace, and naturally the more viscous the oil the greater the resistance to disruption. Viscosity is molecular friction, i.e., resistance to change of form, and is an expression of the time taken by a given quantity of oil to flow through a standard orifice, it is expressed in seconds. Viscosity decreases rapidly at first with rise of temperature and then more slowly as shown in diagram Fig. 8.

The mechanical atomiser is without doubt the most suitable for ships' use, and in all oil burning installations on the pressure system the fuel heater is in the author's opinion not even second to the burner. Its function is to raise the temperature of the oil to as near the firing point as convenient and to reduce the viscosity so that when forced through the sprayer the oil will enter the furnace in the form of a very fine spray or mist. There are several types of heaters in use, the most common being the condenser type and the coiled tube type, the latter is simpler and more efficient as indicated in diagram Fig. 9, which is abstracted from a paper by M. Boilla, Italian Corps of Naval Architects, which was published in "Engineering," Vol. 103, No. 2,670; this paper covered tests of oil coolers, but of course will hold good for oil heaters.

Fig. 9 is specially interesting as it shows that the spiral coil cooler 4 (or heater) is about twice as efficient as the condenser type 5, considered as a heat transmitter, besides being very much simpler in construction.

One cannot emphasize too much the importance of bringing the oil to the furnace in such a state that combustion will be rapid. In the case of oil burning the rate of combustion must be rapid because the fuel is in motion and as soon as the oil spray enters the furnace it is carried forward at the same velocity as the air of combustion. The velocity with ⅝-in. water pressure at the furnace will

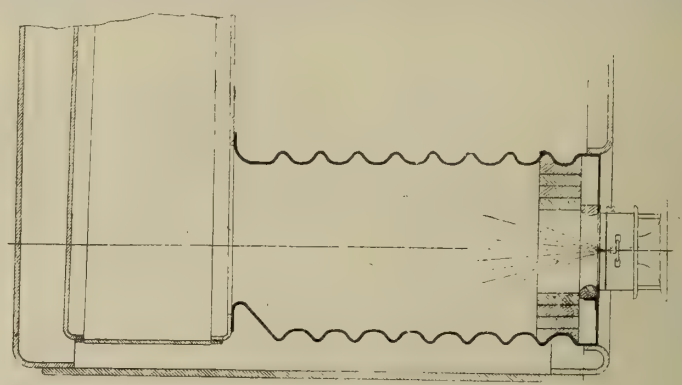


FURNACE WITH HOWDEN'S FORCED DRAUGHT, SUITABLE FOR COAL ONLY OR OIL ONLY.

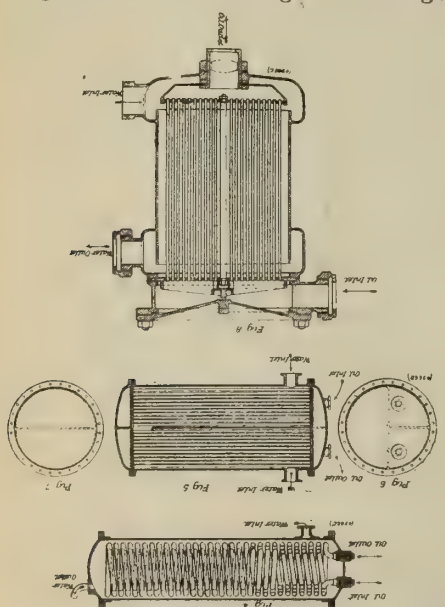
Types of Oil Coolers.	Weight.	Diameter.	Height or Length	Space taken up	Cooling Surface.	Weight.	Space taken up.	Coefficient of Transmission.
	Lbs.	In.	In.	Cub. ft.	Sq. ft.	Per sq. ft. lb.	Per sq. ft. cub. ft.	B.T.U.'s per sq. ft., per deg. F., diff. per hr.
Oil Cooler, Figs. 1 and 2..	= 772	31.6	39.4	17.7	28	27.6	0.62	33 to 59
Oil Cooler, Fig. 3	=1,234	13.8	110.3	9.5	484	2.56	0.02	.. to ..
Oil Cooler, Fig. 4	= 992	15.7	118.1	13.4	215	4.61	0.063	66 to 73
Oil Cooler, Fig. 5	=1,543	23.6	66.9	17	204.52	7.54	0.084	25 to 35
Oil Cooler, Fig. 8 ..... (two elements).	= 265	12.6	13.7	2.3	62	4.26	0.038	136 to 180

be 22 ft. per second, and with a length of furnace only 7 ft. it means that every particle of oil sprayed into the furnace must combine with the oxygen of the air, and be converted into CO_2 in the space of one-third of a second, if combustion is not completed in one-third second some of the unburnt oil comes in contact with the relatively cold furnace plate or tubes, and adhering thereto forms a tarry mass which becomes converted into carbon by the heat of the furnace. In effect the furnace is turned into a still, the fluid portion of the oil only is burned and the solid carbon remains in the furnace. The same trouble will sometimes occur due to a dirty burner nozzle, when some of the oil is allowed to impinge on the furnace tube, combustion is checked and carbon forms. As soon as the formation of carbon is noticed it should be removed to prevent the danger of local overheating, this point cannot be too strongly insisted upon. The temperature to which oil should be heated depends entirely upon the kind of oil used, each oil must be treated on its own merits. As a general rule the oil should be heated to a few degrees below its flash point, if heated above its flash point gas will form in the pipes and result in irregular intermittent flame at the burners.

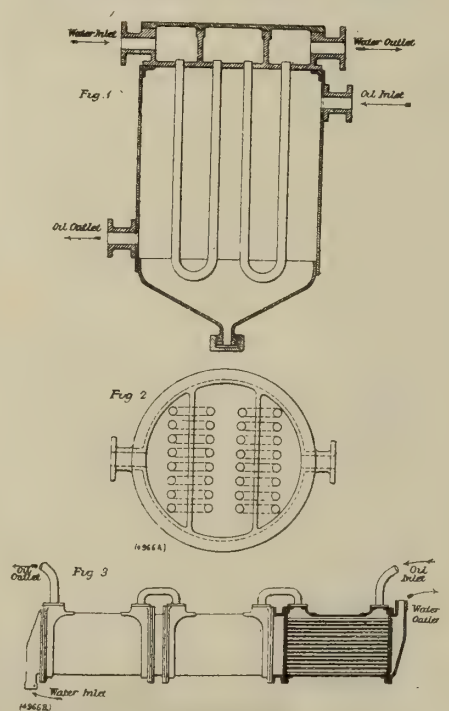
Fig. 10 shows five different furnace arrangements of oil burning. The arrangements shown on illustrations A B and C are advised by the makers when the change from coal to oil fuel and vice versa has to be frequently carried out and time does not permit of removing the firebars and backbridges as with these arrangements the time of conversion from oil to coal and vice versa is a matter of minutes only. The arrangements indicated on illustrations D and E are to be preferred where time will permit of the removal of the coal burning gear as indicated. Forced draught is preferable to natural draught. (Drawings for Fig. 10 were kindly lent me by the Wallsend Slipway & Engineering Co., Ltd.). As the fuel is in motion and not stationary as in the case of coal burning, grate area is not a factor, and furnace volume takes its place. It is furnace volume with correct admixture of air that determines the amount of fuel that a boiler can consume. One of the advantages of burning oil is the simplicity of control of the air necessary for combustion. On the other hand this may prove a disadvantage in careless hands, because it is much easier to lower the efficiency of the furnace, by admitting an excess of air, than is possible with coal. Oil usually requires about 250 cubic ft. of air per lb. of oil. The air for combustion should be raised to a temperature of not less than 300 degrees Fah. before entering the furnace; it is obviously wrong to raise the temperature of the oil to 200 degrees or 220 degrees and then admit air at 120 degrees.



Furnace arrangement for oil burning only, natural draught. To burn oil, fire bars, etc., must be stripped.



OIL HEATERS.



OIL HEATERS.

METAL CUTTING MACHINE

The Yoder Co., Cleveland, Ohio, have issued a machine for use in cutting sheet metal into strips suitable for various purposes. It is claimed that this equipment provides a rapid means of performing the operation and that the work is done in a way that insures parallelism of the edges. Machines of this type are made in several sizes to accommodate various widths and thicknesses of metal.

ENGLISH SHIPBUILDING ACTIVITIES

On Tuesday, November 16th, 1920, Messrs. John I. Thornycroft & Co., Ltd., launched at their Woolston shipyard their third cargo steamer within the past few weeks. This was the SS. Ville de Dannemarie, building to the order of Messieurs Le Groupement Industriel de Charbone et de Transports, Rouen, France. The launching ceremony, including the christening of the ship, was gracefully carried out by Mrs. Girdlestone Kimber, wife of Engr. Comdr. J. L. Kimber, R.N., Admiralty Overseer and Engineer Overseer for the district.

The Ville de Dannemarie, which was designed by her builders, is of the firm's

standard well deck, with raised quarter deck type. Her principal dimensions are: Length (b.p.) 240 ft.; breadth (moulded), 36 ft.; depth (moulded), 18 ft. 6 inches; draught, 16 ft. 9 inches, and her tonnage (d.w) about 2,000. She is built of mild steel to Lloyd's requirements for a 100 A-1 class cargo steamer. The vessel's two cargo holds, one forward and the other aft, contain a combined capacity of 90,000 cu. ft., while coal bunkers for 150 tons are also provided. Water ballast is carried in the cellular double bottom and in fore and aft peak tanks.

The propelling machinery, constructed in Messrs. Thornycroft's Engine Works, consists of triple expansion engines, having cylinders 18 in. x 30 in. x 50 in. diameter by 33 in. stroke, developing 900 I. H. P., and giving the ship's speed of 9½ to 10 knots. Steam is generated in two Scotch boilers, each having two furnaces. These boilers are each 10 ft. 6 in. in length, 13 ft. 2 in. in diameter, and provide a working pressure of 180 lbs. per sq. inch. The 7½ in. circulating pump is supplied by Messrs. Drysdale; the general service pump and the auxiliary food pump, each 6½ in. x 4½ in. x 6 in., supplied by Messrs. Carruthers, are of the duplex type, while the Mumford duplex ballast pump is 8 in. x 9 in. x 8 in. The cargo handling equipment consists of four 7 in. x 10 in. steam winches by Messrs. Rogers; two are placed in the forward part of ship and two aft. Four large cargo hatches equipped with eight 3½ ton derricks of pitch pine facilitate the rapid handling of the coal or general cargo which the ship is destined to carry. Accommodation for the captain and officers is provided amidships, while that for the crew is arranged in the forecastle. It is expected that this ship will be completed and ready for delivery to her owners in about six weeks' time.

Facts Regarding the Oxy-Acetylene Process

The Examples of Work Shown with Data Pertaining Thereto, Have Been Compiled by Author from Information Applied by L'Air Liquide Society

By J. H. MOORE

THE fundamental principles of oxy-acetylene welding are easily understood, and when one has already a rudimentary knowledge of the physical and chemical properties of metals, it does not take long to become proficient in the work after some experience has been acquired in the use of the necessary apparatus. The two gases, oxygen and acetylene, are well known and need no explanation. Oxygen is compressed and supplied in steel cylinders. Acetylene is supplied in dissolved state in cylinders first filled with a porous material soaked with acetone, which removes any risk of explosion, or may be obtained from a suitable generator.

Acetylene, when burnt in equal proportions with oxygen produces a neutral flame (that is, neither oxidizing nor carbonizing), of an estimated temperature of over 7,000 degrees Fahrenheit. All metals under the direct influence of this intensely hot flame melt rapidly. Suitable additional metal is added to fill up the groove between the two pieces and results when allowed to cool in a perfectly homogeneous joint of practically equal strength to the metal adjacent. The gases pass through regulators specially designed to reduce the pressure of gas emanating from the cylinders to a suitable working pressure, afterwards passing through special flexible tubing into the body of the blowpipe in which they mix in predetermined proportions.

Perfect results, however, can only be obtained by the use of perfect apparatus. In selecting apparatus it is essential that only the best is purchased. The question of cost therefore should not be the only consideration to enter into when the question of purchase is considered. So called "cheap" (or inferior) apparatus is not only detrimental to good work but represents an element of risk to the operator, and a few dollars presumably saved on the first cost would be more than lost the first time of using it; besides being wasteful in the use of gases, with the likelihood of discredit to the worker or his employer arising in the future.

On the other hand, when perfect apparatus is used the results obtainable are only limited to the skill of the operator. The cutting of wrought iron and steel is based on the well-known fact that when iron is heated to a high temperature in the presence of pure oxygen it rapidly burns, and forms oxide of iron, which melts at a lower temperature than the metal itself. The apparatus for oxy-acetylene cutting is similar to that used for oxy-acetylene welding except that the blowpipe or cutting torch is so constructed that a stream of pure oxygen acts on the heated metal and oxidizes it. The resulting oxide liquefies almost simultaneously and is blown away by the action of the blowpipe. This process of oxidation and liquefaction is rapidly repeated until the metal is severed by a clean and narrow cut, either through its entire depth or such part of it as may be required.

Cutting by Oxy-Acetylene Process

Cutting all thicknesses of wrought iron and steel by the oxy-acetylene process has now become a common method. Not only is the cutting by this process rapid, but it is also very much cheaper in consequence of the enormous saving of time and labor. It is practically as easy for the operator to cut a circle or any other design as it is for him to cut straight across, which is all that can be done, of course, by sawing.

There is hardly any limit to the thickness of steel, etc., which can be cut by this process if proper equipment is used, and the many machines that are on the market designed for the cutting of heavy thicknesses of steel, working more or less automatically, and the success they have attained, bear testimony to the essentialness of such a process.

For ordinary purposes, where the metal

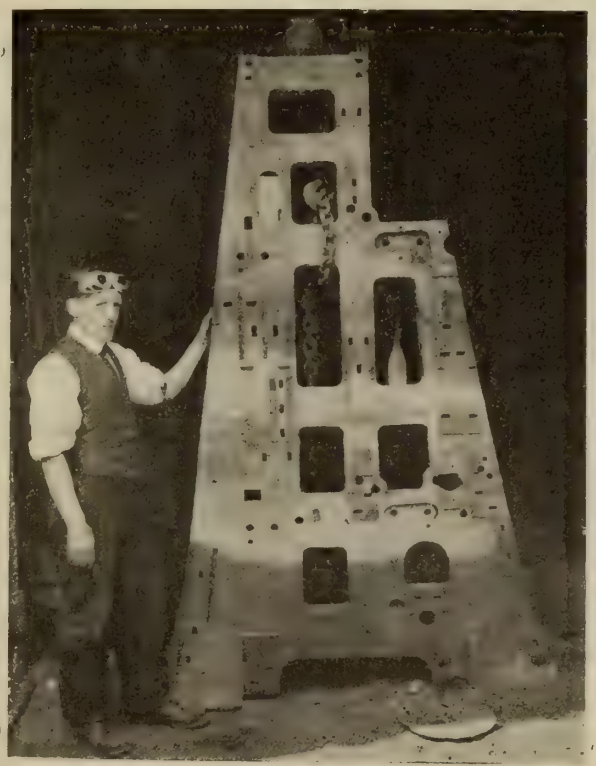


FIG. 1—A GOOD EXAMPLE OF HOW THIS STYLE OF WELDING CAN BE USED TO ADVANTAGE.

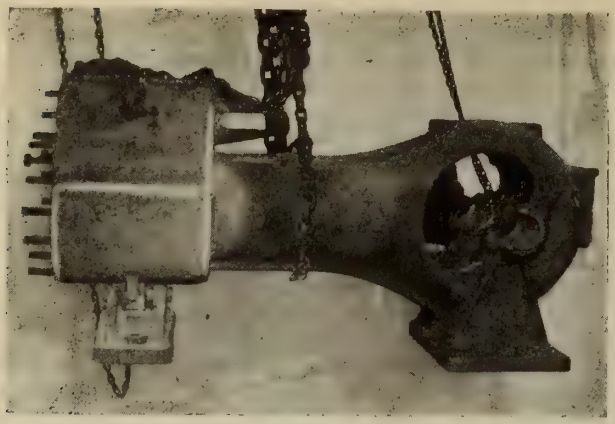


FIG. 2—THIS ENGINE CYLINDER WAS REPAIRED IN 48 HOURS.

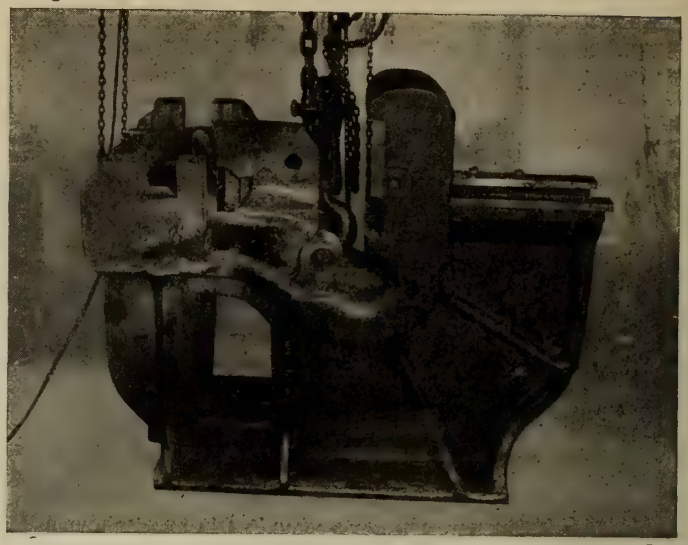


FIG. 3—A NAIL MACHINE THAT ANSWERED TO THE ROLL CALL IN 48 HOURS AFTER DISABLEMENT.

is only a few inches in thickness the work is very easy and requires no mechanical assistance; in fact, a man can become an expert operator after very little training.

The question is sometimes raised as to whether cutting by the oxy-acetylene flame has any harmful effect on the material, and the answer is emphatically, No! Mr. P. F. Willis, who is an impartial authority on the subject, makes the following allusion to this subject in his book "Oxy-Acetylene Welding and Cutting." "Is there any detrimental change in material when cut with oxygen?"

No. On high carbon steels there is a slight softening of the metal for a distance of about ⅜ inch from the cut, due to the annealing effect of the heat. Numerous tests have been made and all bear out the above assertion. The results of one such test may prove interesting. A steel plate ¾-inch thick and 14¾-inch long was used.

	Test No. 1 Original Stock Before Cut	Test No. 2 After Cut
Tensile	47,620 lbs.	50,110 lbs.
Elastic Limit	31,640 lbs.	29,930 lbs.
Elongation	33%	33%
Reduction of Area	35%	42%

It is an advantage, when cutting, to have the blowpipe perfectly steady, with the tip at a distance of about ⅛-inch from the surface of the metal, for ordinary thicknesses.

Cutting discs out of steel plate is a comparatively simple process, and requires very little skill on the part of the operator. Some concerns supply a circular cutting guide which enables the operator to cut a perfect circle of almost any diameter with no more effort than is required to control the blowpipe. Cutting heads off rivets when repairing boiler and structural steel without injury to the plate, is also a particular advantage of this process. By cutting off the head, it only requires a tap of the hammer to knock out the rivet. In certain instances, this is the only practical method of taking out rivets, especially in places where they are inaccessible to a hammer and cold set.

For cutting cut discs and intricate designs in iron and steel this method is especially valuable. Cutting up scrap and dismantling steel structural work is also an important field for the oxy-acetylene process, and is the solution to many problems of a similar nature, such as clearing up wreckage after a fire, train disasters, etc.

Its Efficiency and Economy

The time was, and not long ago, that when an important part of machinery broke there was no alternative but to replace it by a new part if procurable, or patch it up by some crude method which usually could be depended upon to give but temporary service only. Sooner or later the time would come when a new part had to be obtained or the machine discarded and condemned

FIG. 4—A FEW HOURS MADE THIS FACE PLATE AS GOOD AS NEW.

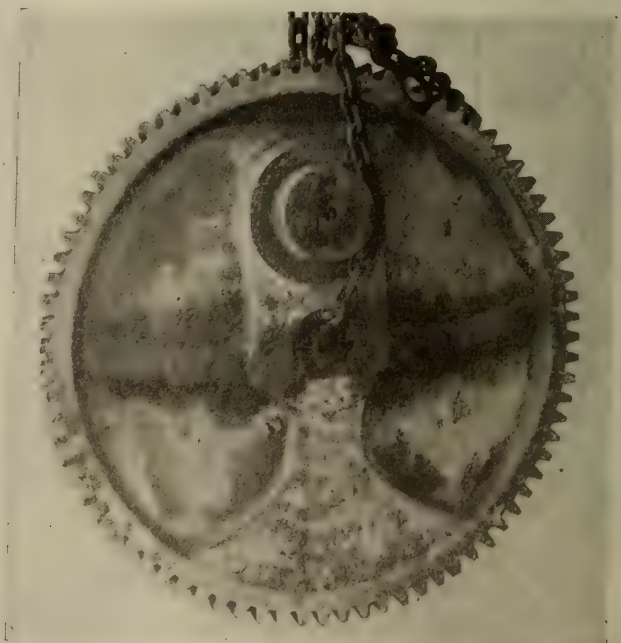


FIG. 5—A FEW HOURS WAS ALL THAT WAS NECESSARY TO PUT THIS GEAR IN WORKING CONDITION.

FIG. 6—THE CYLINDER BEFORE WELDING.

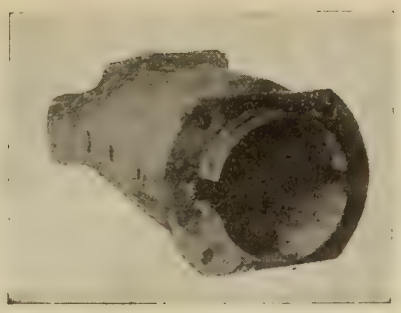


FIG. 7—HOW IT LOOKED AFTER BEING WELDED.

altogether, and replaced by a new one.

Probably at that time, when such machinery was comparatively cheap to buy, this might have in the end been considered economy as one could naturally get more service from a new machine than an old one more or less out of order, but with the advent of the oxy-acetylene process of welding these methods came to be looked upon as unnecessarily wasteful, and at the present time would be regarded as positively inefficient.

With the speeding up of all industries directly or indirectly concerned in the production of war material, machinery and equipment became taxed to the utmost so that when an important part or a casting became broken oxy-acetylene welding was looked upon as a highly practical and efficient method of restoring it to use again—not only from the standpoint of economy, but because it might be welded in a few hours and made practically equal to new, whereas to procure a new part would take very often several weeks, and in the case of foreign made machinery, would be altogether unobtainable.

The more the price of machinery has risen and the greater the scarcity of metal of all kinds, the more valuable the oxy-acetylene process has come to be regarded until it is now looked upon as an indispensable necessity in all industries, and for all purposes where the joining of metals is involved. There is practically no inherent weakness in the welded joint when the work is properly performed, especially on cast iron and steel. The tensile strength of a weld on cast iron is equal to or greater than the metal itself. In the case of steel, the welded part is about 90 per cent. to 95 per cent. of the strength of the metal.

Even on brass and copper, upon which welding is not attempted as often as it should be, the results are better than can be obtained by riveting or any other method of joining which are consequently rapidly being superseded by welding.

It will therefore be seen that this process holds out many advantages, especially to the manufacturer of metal furniture and utensils, cylinders, drums, containers, etc., where a joint of neat appearance and absolutely leak-proof is necessary; and where the article has to be subjected to great pressure. After smoothing off the welded part it is quite impossible to detect the joint so that it is for all practical purposes seamless.

In certain cases such as the manufacture of bakers' dough vats, where it is necessary that the article, when in use, has to be absolutely clean in every respect, the fact that there are no seams or apertures which would make it difficult for the receptacle to be kept quite clean and free from deleterious matter, the practically seamless article made by oxy-acetylene welding has much to commend it even when strength is not of great importance; furthermore, more often than not it can be made cheaper by this than any other method.

There is hardly an industry of any kind but has its own use for this process in some way, either for repairing or manufacturing, or for some other purpose incidental to either of these two. To recount them all would be quite impossible, but the following are a few of the uses to which it is most comomnly applied, and will be sufficient to give a general idea as to the many other similar uses to which it could be profitably adapted.

Railroads are saving thousands of dollars yearly and keeping their rolling stock in constant service by welding broken locomotive cylinders, drive wheels, welding cracks in fire boxes,

FIG. 8—AUTOMOBILE CYLINDER BEFORE WELDING.

mud rings, flues in flue sheets to eliminate leakage, broken forgings of all kinds, cracked or defective steel castings, broken flanges on cylinders, frames, crossheads, quadrants, reverse levers, etc., etc.

Shipyards, by repairing broken cylinders, broken propeller blades, damaged engine parts, boilers, davits, stern posts, cutting manholes and portholes in steel plates, cutting up wreckage, etc. Steel and brass foundries by building up defective castings, filling up blowholes, welding cracks and otherwise saving parts which, by being somewhat defective, would be useless for the purpose required; cutting off steel gates, risers and runners, welding cracks in bronze bells, etc. Pulp and paper mills by welding broken gears, machinery parts, paper cores, etc.

Machine shops are reclaiming parts that have flaws in them, either by accident or other fault, and saving the amount of work spent on them; welding broken machinery parts, etc. Big savings are also being effected in various industries by welding high speed steel to low carbon shanks and using up every part of a tool after it has become too small for ordinary use. This admits of the whole of the high speed steel being utilized, which, owing to its high cost, is an important consideration.

Garages also have many and important uses for this process for welding broken crank cases, cylinders and water jackets, lengthening and straightening chassis, welding broken crank shafts, gear shift rods, fenders, gasoline tanks, radiators and many other broken or damaged parts but which it would take too long to enumerate. So manifold and varied are the uses for the process that it has almost come to be regarded as an axiom that, whenever two pieces of metal are to be joined, the best and most economical method is to weld them.

Believing readers will be interested in actual illustrations of work performed we show throughout this article some examples of good judgment in welding. The first of these, Fig. 1, shows a part of a handkerchief-making machine, which, together with about 100 small parts, was broken in transit. As this machine was made in France, an attempt to secure a new casting would have caused untold delay. The dimensions of all the slots shown were in millimetres, which made it still harder to even contemplate making a new pattern. The expense of replacing, not to speak of delay, would have been considerable.

FIG. 9—THE CYLINDER AFTER WELDING.

The problem, however, was easily solved. The casting was welded by the oxy-acetylene method, and restored to use again within a few hours. It was practically equal to new, and the cost of

(Continued on page 100)

FACTS REGARDING THE OXY-ACETYLINE PROCESS

(Continued from page 422)

repair was comparatively low. This casting was broken through the middle and by looking closely the welded section may be seen.

Fig. 2 illustrates a gas engine cylinder weighing 1,500 lbs. that got cracked by frost. Again the outlay to replace would have been considerable, and the cost an item to be seriously considered, but welding proved the solution. In 48 hours the engine was dismantled, the bed welded and the engine re-erected ready for service again.

Consider the case of Fig. 3. This was a nail machine bed that broke through the middle and looked like a serious matter for a while. In 48 hours, however, the machine was again fit for service and the repair made at very little cost.

The next example, Fig. 4, depicts the face plate of a large wheel lathe, which was used for machining locomotive drive wheels. It became broken by accident and represented a loss of some hundreds of dollars. Four hours was all that was necessary to have it again equal to new.

When a large flywheel of the size shown at Fig. 5 and weighing 3,500 lbs. is incapacitated from service, a serious loss must inevitably follow unless it is possible to repair it again quickly. This was done by oxy-acetylene welding as before, and the saving in time and money effected may be easily imagined and further comment is hardly necessary.

The next two illustrations, Figs. 6 and 7, show a Hart-Parry gasoline engine cylinder that weighed 325 lbs. It has a ten-inch bore. The views show it before and after welding, and the work in its entirety only took about three hours.

The remaining two illustrations, Figs. 8 and 9, depict an automobile cylinder before and after welding. For reclaiming such parts this process is ideal, and has saved many a dollar. There are, of course, hundreds, yes, thousands, of cases that could be quoted and illustrated showing how this system has proved of decided value, but enough has been illustrated to start the ball of thought arolling. We appreciate the courtesy of L'Air Liquide Society, who very kindly loaned us these illustrations, as examples of work performed. Oxy-acetylene welding is only in its infancy, and the chief thing to do is to have confidence in it, then follow up that confidence by actual use.

WIRELESS HELPS BUSINESS

A striking example of the commercial value of wireless telegraphy equipment on a cargo boat is reported in "Syren Shipping." The vessel was outward bound to the States in ballast, seeking a freight on account of the uncertainty in the coal trade. She was damaged in heavy weather and the master sent a marconigram stating that he was returning to Barry Roads. This was received by the owners in London at 1 p. m., and as the ship was unfixed they 'phoned to Cardiff and fixed her for Genoa with coal at 50s. per ton—the top rate for that day. The ship arrived the next day and at once docked and commenced loading. By the following morning the market had already dropped 10c. No doubt such instances could be multiplied ad lib., but this suffices to show that in addition to its life-saving and other utilities, a Marconi installation is a very important business asset to the shipowner.

A HARD VOYAGE

The steamer "West Wauneke" arrived and docked in Boston recently after a very strenuous time on the North Atlantic. Her oil fuel proved unburnable, and the crew were forced to burn all the deck fittings and woodwork they could break down, in order to keep the donkey boiler going, to work the steering gear and pumps. When this gave out they had to steer and pump by hand. Several steamers attempted to to- but the weather was so bad that the towing hawsers parted repeatedly. The men's morale was so poor that by the time the vessel reached port the police had to be sent for, as the men were fighting among themselves and mutinous. Four vessels were engaged in the towing, the final stretch being accomplished by a couple of the U. S. coastguard vessels. The oil that refused to burn was shipped in London, it is claimed. The "West Wauneke" gave 4000 barrels of her original oil fuel to a steamer in St. John's, Nfld.

A FAMOUS LIVERPOOL FIRM

The firm of C. W. Kellock & Co., ship brokers for one hundred years in the port of Liverpool, have issued a little history of their firm, aptly entitled "100 Not Out." This of course alludes to their unbroken record of business since 1820, and that they are still going strong. The book, besides being a history of the firm, is a very interesting history of the port, and some of the leading figures in its maritime life. Among some of the notable sales recorded in the firm's history were those of Russian ships captured in the Crimean war and in this connection it is interesting to note that the firm acted for the British Government in the late war. The famous "Great Eastern" also passed through their hands, and another great sale was that of 78 ships realizing nearly $3,000,000, most of which had been built in Canada. Some of the prices received for ships in those days are worth noting. The "Queen of the Seas," built of wood, and guaranted to be the finest Colonial ship in the world, was sold for £11-5-6 a ton in 1853. The "Dumbarton Youth," an A1 screw steamer, 126 feet long, was sold for £3,000. She was later sold for £4,250 to Alfred Holt, and became the first steamer of the famous Blue Funnel Line. Names of such famous vessels as the old "Arizona" and "Alaska," as well as the old National liner "America" bring back old memories.. We congratulate Messrs C. W. Kellock on their long innings, and hope they will carry their bat for another century.

LAUNCHING OF C. G. S. CANADIAN HARVESTER

The Port Arthur Shipbuilding Company, Limited, launched the C. G. S. Canadian Harvester at noon on Saturday, November 20th, 1920.

This vessel is being built for the Department of Marine of Canada, and at the request of the Minister of Marine, Mrs. Frank H. Keefer, wife of the member of the Federal house for the district of Port Arthur and Kenora, christened the boat. Mr. Keefer is also Under-secretary of State for External Affairs of the Canadian Government, and has taken a prominent part in the framing of the trade relations between Canada and the West Indies. It is into trade with the West Indies that the Canadian Harvester will likely be placed when completed.

The Canadian Harvester is the seventh, and will be the last vessel to be built by the Port Arthur Shipbuilding Company, Limited, for the government under its present merchant marine program. Mr. Keefer, in his capacity as Federal member, was largely instrumental in securing for the Port Arthur yard, the only one in his district, the contract for this boat. For the above reasons, it was fitting that the vessel should be sponsored by Mrs. Keefer.

The Canadian Harvester is a steel freight steamer for ocean service:

Length over all, 260 ft. 6 in.

Breadth molded, 43 ft. 6 in.

Depth molded, 26 ft.

Deadweight carrying capacity, approx., 4000 tons.

She is fitted with 'tween decks, poop bridge and forecastle.

Propelling machinery, built by the Port Arthur Shipbuilding Company, Limited, consists of a triple expansion surface condensing engine, having cylinders 18 in. x 50 in. with 36 in. stroke, designed to develop about 1300 horsepower, and to give the vessel a speed of 10 knots.

Boilers, built by the Port Arthur Shipbuilding Company, Limited, consist of two Scotch boilers, length 10 ft. 9 in., diameter 14 ft., with Howden forced draught, designed for a pressure of 180 pounds.

The Canadian Harvester will be fully completed at Port Arthur during the winter and delivered there to the government when navigation opens.

The Port Arthur Shipbuilding Company, Limited, has under construction for private owners canal size lake and ocean freighter of approximately 3000 deadweight tons, for spring delivery.

ALTHOUGH no definite statement has yet been made at the Vancouver or Victoria offices of Dodwell & Company, agents for the Holt Line, or B. C. Keeley, general manager of the Canadian Government Mercantile Marine on this coast, it is understood that the first outward sign of the traffic agreement between the two concerns will be given shortly after January 1, when the Blue Funnel (Holt) liners commence using the Dominion government wharves at Victoria and Vancouver. When this is done there will be terminated an arrangement between the Holt line and Evans, Coleman & Evans, in Vancouver, and R. P. Rithet & Company, in Victoria. That the Blue Funnel line proposes to introduce passenger liners in the trans-Pacific trade, to operate in the trans-Pacific trade in conjunction with the Merchant Marine, is the latest report from the Orient, and vouched for by officers of the Osaka Shoshen Kaisha. The Japanese companies seem to have got wind of the proposals.

The Blue Funnel line maintains a splendid fleet of passenger and freight liners on the route between the United Kingdom and Australia, and if there is any foundation for the Japanese report, it may mean that passenger boats of this class may be pressed into the North Pacific service between British Columbia and the Far East. The liners at present operating in the Pacific for the Holt Line are big cargo-carriers, with only limited first-class passenger space. The big passenger ships operated by the company in other routes are of the latest type with splendid accommodation, and if placed on the Pacific would be strong competitors for the increasing traffic on this ocean.

The largest deal in shipping affairs of Vancouver this year was made known when it was announced that the Terminal Steam Navigation Company had been absorbed by the Union Steamship Company of British Columbia. The transaction has been pending for some weeks and about $250,000 is involved. The company will shortly have a new steamer built for the Bowen Island service to carry about 1,200 passengers. This will replace the Ballena, which was burnt to the water's edge at Coal Harbor recently. The Bowena and Capilano will carry on until the completion of the new vessel, which will probably be constructed at a British Columbia yard, costing in the neighborhood of $250,000. Capt. J. A. Cates is manager of the Terminal Steam Navigation Company, whose entire holdings, including even a big dairy farm on Bowen Island, have been purchased by the Union Steamship Company.

The Harbor Marine Company, of Victoria, is now negotiating with Peruvian interests, backed by the Peruvian government, in connection with a contract involving the construction of four 8,000 ton steel tank steamers.

Since the closing of the Great Lake ports grain is commencing to move westward for trans-shipment through Vancouver. Announcement was recently made that orders have been closed for 5,000 tons of wheat for the United Kingdom, to pass through Vancouver, and it is expected that 5,000 additional tons will be ordered in the near future, with even more in prospect before spring opens navigation on the Lakes. The motorship Buenos Aires, of the Gardner Johnson line of Swedish motorships, will take the first wheat cargo, consisting of 3,000 tons. C. H. Lambson, of the traffic department of the Johnson Company, has been studying the situation for some months in San Francisco, where he went to obtain charters for ships to carry grain to the United Kingdom out of Vancouver. The rate on the first 5,000 tons is $23, but Mr. Lambson believes that with so many vessels seeking freight it will drop to $18 or $19. This will add to the increased movement. Oats are also beginning to pass through Pacific coast ports. The government elevator at Vancouver has handled 50,000 bushels this season, and expects a large quantity to follow. This grain is moving to the United States.

It is reported that an agreement has been reached between the Dominion government and the Canadian Pacific Ocean Services, Ltd., for the handling of all Canadian mail to the Orient, from Victoria and Vancouver, at a fixed price per pound. It is stated that the terms are similar to those in force for the transportation of United States mail to the Far East. For some months the C. P. O. S. liners were operating to and from the Orient without a pound of Canadian mail in their holds owing to a disagreement between the steamship company and the Dominion postal authorities regarding the mail subsidy. During this period the Canadian mails were carried by the Japanese steamships. Recently, however, the Canadian liners have resumed carrying of Canadian mails.

If plans proposed by R. B. Teakle, general manager on this coast for the Canadian Government Mercantile Marine, are adopted, steamships belonging to this fleet will carry the maple leaf emblem on their funnels. The prefix "Canadian" to their names, the distinctive house flag, and the ports of registry all lend distinction to the C. G. M. M. steamships, and the maple leaf on the funnel would serve to give further emphasis to the fact that Canada is in the shipping and shipbuilding business with both feet.

Captain Holmes Newcombe, veteran of the British Columbia fisheries patrol service, has been appointed senior officer in charge of the vessels composing the fleet of this service, and news of the appointment presages the complete reorganization of the department. All vessels of the Dominion Government fishery patrol service on this coast, with the exception of the Thiepval, were recently ordered laid up in Esquimalt harbor. This action was taken "in the interests of economy," according to an official dispatch from Ottawa. The steamers Armentieres, Givenchy, Malaspina and smaller fisheries craft are affected by this order, but in view of the appointment of Capt. Newcombe, it is believed that the change is merely the forerunner of other developments directed at placing the service on a more efficient basis. Captain Newcombe has been associated with the fisheries service for the past eighteen years. He was in command of the old Kestrel, which was sold in 1912, and subsequently commanded the William Joliffe, the Malaspino and latterly the Stadacona.

Captain Lincoln Rogers, vice-president of the Vancouver Dredging and Salvage Company, well known for many years in Pacific coast shipping circles, died at his home in Vancouver on November 15. He was born in Victoria in 1864. In 1883, with his uncle, William Rogers, he built the steamer Robert Dunsmuir and later the City of Nanaimo, later named the Bowena, one of the largest and best built vessels operating on the coast at that time. Captain Rogers was in command of the City of Nanaimo for some time. After retiring from active seafaring life in 1906 he became manager of the Burrard Steamship Com-

pany and the Lincoln Steamship Company.

Material reductions in water freight rates on lumber, flour, cement and coal are included in the new schedule adopted at a joint meeting of the San Francisco and Puget Sound branches of the Pacific Westbound Conference in Seattle recently. The new schedule fixes a rate of $15 per thousand feet on lumber, a reduction from $17.50. The rate on flour is reduced from $10 to $7 per ton and on cement from $10 to $9. Utah and Wyoming coal will be carried at $6.50 a ton to enable producers to successfully compete with the coal of British Columbia fields. When railroad rates to the seaboard are added to the cost of the coal at the mines, the total rate on coal from the two states will be about $10 a ton, which is the rate now charged on Canadian coal. The conference agreed that, should this rate prove lower than the rate on Canadian coal, it will be revised. Among the companies that agree to abide by the terms of the new schedule are the Blue Funnel Line, the Robert Dollar Company and the Japanese shipping concerns.

The Nippon Yusen Kaisha is now routing its freight steamships direct from Seattle and Vancouver, eliminating the customary call at Victoria. This plan has been in force on the Osaka Shoshen Kaisha schedules for some time, but the Nippon Yusen Kaisha has been leaving out Vancouver altogether and discharging freight at Victoria for transshipment to the mainland. It is claimed that the direct routing to Vancouver is a movement in the interest of economy.

The auxiliary schooner Laurel Whalen has been purchased from French interests by the British Columbia Cement Company of Victoria, and it will be used as a depot ship for the company's two plants at Bamberton and Saanich Inlet.

The company paid about $50,000 for the schooner, which had a brief but eventful career as an ocean carrier. Built in 1917 by the Cameron-Genoa Mills Shipbuilders, Ltd., Victoria, the schooner was chartered to carry a cargo of lumber to Australia. She was buffeted by successive storms and spent many months undergoing repairs in various South Sea ports. She carried tallow on the return voyage. She got into another storm and was forced to put in at Auckland. She started out again only to run into a hurricane, which disabled her. Finally the schooner reached Papeete and after further misfortunes got as far as Victoria.

Operation of a further augmented service by the Nippon Yusen Kaisha in the trans-Pacific route shortly after the new year commences is now predicted. It is proposed to operate the four large passenger and freight steamships already in the service, and in addition five freight carriers of the "T" class. Three of these latter class vessels, the Tajima, Toyohashi and Toyama Maru, are now operating on the North American route.

A direct line of freight and passenger steamers between Pacific coast and European ports, intended principally to divert to the west a portion of the Mediterranean emigration now going to the Atlantic seaboard, will be established by Swayne & Hoyt, a San Francisco shipping firm, if the United States Shipping Board allocates the vessels necessary. Application for three of the "535" vessels being turned out by the Shipping Board for both freight and passenger travel has been made to the San Francisco offices to be forwarded to Washington. Among the European ports to be served by the proposed line are Cadiz, Barcelona, Marseilles, Genoa and the Piraeus.

MONTREAL NOTES

THE Port of Montreal has now assumed her usual winter appearance and active operations about the harbor are practically suspended. Some activity is noted in the work of preparing the sheds for the winter season, but in all other respects the business for this year is about over. The last vessel to leave the port was the Lake Gatun, this boat passing down the river on her way to New York on December the 7th. Immediately after the sailing of the Lake Gatun, vessels belonging to the Department of Marine and Fisheries commenced the work of taking up the buoys, and this work has now all been completed. An interesting feature of the buoy-raising this season was the taking of moving pictures of the different operations. In conjunction with similar views that were taken in the spring of the laying down of the buoys, these pictures will be shown at the local theatres for the information of the public. With this work completed, the only navigation marks left in the river will be the permanent buoys that mark the bends and principal courses to guide the work of the ice breakers and belated vessels. The river is beginning to freeze in many of the calm and shallow places, but the main current is still open. During the last week or so of navigation it was only possible for daylight traffic up and down the river, owing to the fact that all light buoys had been taken up.

It was expected that the Col. Rochester and the Col. Carr, two vessels belonging to the U. S. government, would winter at Montreal, but following some light repairs made to these boats at the Montreal Dry Dock, both of the boats possed down the river on their way to an American ocean port.

The plant of the Anglo-Canadian Wire Rope Company at Rockfield is now in full operation, manufacturing all sizes of steel rope up to 1¾ inches in diameter. D. W. Clark, of the Canadian B. K. Morton Company, is the president, and Lt.-Col. T. S. Morrisey is the managing-director and likewise vice-president.

A weekly service has been established by the Canadian Government Merchant Marine between Halifax and Newfoundland, and this will continue in operation throughout the winter. The steamers to be used will be the Canadian Miner and the Canadian Sealer. The former has been on the Montreal-Charlottetown-St. John's route, and the Canadian Sealer on the Sydney-Levis service.

The Canadian Association of Shipbuilders and Engineers, which took an active part in awakening the public of Canada to the importance of encouraging the shipbuilding industry, and which is in a measure responsible for having legislation uassed in the last session of parliament to extend credits to shipbuilders, has decided to continue its campaign to obtain orders for the Canadian yards and such asistance as will keep the Canadian yards busy, thus furnishing employment to the thousands of skilled men, including a large percentage of returned soldiers, who are said to be without employment.

One of the very late arrivals this year was the vessel Keyvive of the Keystone Transportation Company. She came up the river from Three Rivers on the 10th of December, and it is interesting to note that her passage was greatly aided by the presence of the special buoys that are placed late in the season and left in the river all winter. At present there are 44 of these buoys between Montreal and Three Rivers, and this number is being added to from year to year. These permanent buoys are specially designed to withstand the pressure of the ice and have proved very valuable in assisting late navigation.

The Canadian Vickers Company, on November 27th, launched the Canadian Leader, the twelfth vessel constructed by this company for the fleet of the Canadian Government Merchant Marine, and the sixth that has been placed in the water this season. The ceremony was performed by Mrs. W. G. Ross, the wife of the president of the Montreal harbor commissioners, and was witnessed by a large number of prominent representatives of the marine interests of the city and provinces. This latest addition to the fleet of the C. G. M. M. from this yard is a steel vessel of 8,350 deadweight tons, with a length of 423 feet, a beam

of 52 feet, and a depth of 31 feet. She is fitted with triple expansion engines, and has three Scotch boilers equipped with Howden's forced-draught system.

The figures for November, the last month for inland navigation, again show a great decrease, as compared with the same period last year, in the amount of grain shipped through the Lachine canal, from points up the lakes. The movement for the month of November this year showed a total of 1,841,908 bushels, as against 3,823,182 bushels for the previous year. Barley and flaxseed are the only grains showing increases. The increase in barley shipment was about 86,470 bushels, the quantity moving down this year being 153,414 bushels. The volume of flaxseed for the month of November this year was 15,658 bushels against a negative shipment for the corresponding month last year. The decrease in wheat alone amounted to 1,804,650 bushels. Oats, rye and other grains showed substantial decreases. Good increases are represented in the movement of coal through the port. Hard coal to the canal shows a slight decrease, the figures for November of this year being 15,734 tons against 16,851 tons for the corresponding month last year. Hard coal to the harbor for local consumption was 3,489 tons in November, 1919, and 5741 tons in November, 1920, an increase of 2252 tons. The total shipments of soft coal for the month was 162,658 tons, this being an increase of 146,643 tons.

NOTES FROM THE PORT OF SOREL

The Francois C., which is used as a ferry between Sorel and Berthier will be lengthened ten feet, making her 100 feet over all. She will now be able to take on twelve automobiles instead of six as formerly. She is built of steel and has an engine of 9x18x12 inch stroke, her boiler has a pressure of 150 pounds, and the owners have decided to spend $11,000 to give better accomodation to pasengers and automobiles next season.

Messrs. J. H. Dansereau and his sons will start a new pulp factory, the new location being at Sorel on the Richelieu River. New wharfs will be constructed, extensive buildings erected and the industry will give much employment to many hundreds of hands, as they propose to turn out fifty tons of pulp per day for the first year. It is likely the works will be in operation in the fall next year.

S.S. Northern was sold at Sorel for $25,000, the purchaser having to pay $1,000 customs, as she was an American vessel. She is being dismantled and will be sold for scrap. She has two triple-expansion engines, 3,000 H.P., and ten boilers, 12 feet 3 inches by 11 feet 6 inches, with a working capacity of 200 pounds.

The Transportation & Shipping Co., who had two shipyards, will move all their works to the west side of the Richelieu River, where they are now building wooden straight sailing schooners. This is in order to make room for the new pulp mill to be established at Sorel.

S.S. Aranmore, a Government owned vessel, is in the port of Sorel on the ways of the Government Shipyard, where she will be repaired. It will be remembered she was under water the whole of last winter in the Maritime Provinces. She will be able to resume her service carrying buoys in the spring.

S.S. Ralph T. Holcomb, the property of the Edwardsburg Starch Company, is at Sorel being repaired at the Manseau Shipyard. Mr. A. Beaudet, manager of the shipyard, states extensive repairs and alterations will be made to this vessel.

Most of the boats of the Canada Steamship Lines which had been wintering away from Sorel during the last few winters are now in the port of Sorel. It is well known that Sorel is the first harbor up the St. Lawrence where the tide is not felt. Water is deep here and the harbor is well sheltered, the men are used to the work, in fact they are well known shipbuilders and sailors, therefore, the great number of vessels that lay up for the winter in this harbor.

CURRENTS OBSERVED IN THE INDIAN OCEAN

The following interesting report on currents observed in the Indian Ocean was furnished by Capt. L. C. Howard, of the American steamer Mulpau: "The Mulpau, of 6,139 tons gross, passed Achh Head, Sumatra, at 8 p..m, Sept. 2, 1920, bound for the Suez Canal. She was loaded to a medium draft of 19 feet, and her maximum speed under excellent weather conditions was 8.2 knots. Her bottom was very foul. The southwest monsoon was encountered about 50 miles each of Acheh Head and was blowing force 6, Beaufort scale, when we entered the Bay of Bengal. I decided to take the shortest route and headed west. For two days we encountered but little curcent and made fair speed. On the third day the wind hauled to WNW. with a heavy head sea and a current which I estimated to have a set of 135° and a drift of 1 knot per hour. Our speed was reduced to 5 knots. From all available information it did not appeal that I could safely depend on the breaking up of the southwest monsoon for at least a month. My fuel and supplies were limited to 25 days, so I decided to work to the southward into better weather. After running south for 14 hrs. the weather conditions materially improved in lat. 3° N. I then shaped my course for the 1½ degree channel through the Maldives. The weather continued excellent and when in lat. 1° 30′ N., lon. 65° E., I shaped my course for Ras Hafun. A favorable current was experienced until lat. 6° N., lon. 55° E. At this point we entered the great whirl of current so well described on page 45 of Hydrographic Office Publication No. 157. It was one of the strongest ocean currents I have ever encountered, and for 36 hours the best speed we could make was 4 knots. I make every effort to get to the westward, and as I approached Ras Hafun we got out of the southerly set; but between Ras Hafun and Ras Asir no northerly set of any account was experienced. We passed Ras Hafun during the night at a distance of 30 miles. We might have gotten a favorable current by hugging the coast, but on account of the heavy haze over the land I did not care to approach too close. On Sept. 19 we sighted Ras Jard Hafun and passed Cape Guardafui, distant 5 miles; no current at all. A heavy mist hung over the land, but Cape Guardafui was distinctly visible at a distance of 5 miles. A strong southerly wind was blowing all day. Between the Maldives and Ras Asir no strong winds were encountered. Another steamer, the West Campgaw, passed Acheh Head on the same date as the Mulpau. She had better power than the Mulpau and held north through the 9½ degree channel. Her captain states that he experienced fine weather across the Arabian sea; no strong winds. He passed Ras Asir at a distance of 2 miles on Sept. 16, and told me that he had a 3-knot westerly set of current throughout the day, passing Sokotra and Cape Guardafui. I am sure that the southwest monsoon broke up before Sept. 12 this year. I think I had every reason to expect a favorable current through the passage between Sokotra and Ras Asir. The West Campgaw experienced it, but three days later we passed through on nearly the same course with a strong southerly wind and found none. Mokha Light, in the southern part of the Red Sea, although we passed within five miles of it, was not sighted. The shore line was distinctly visible and the night was dark. A heavy haze prevailed which might have obscured the light, although the coast was so distinct that it seemed to me that the light must have been extinguished. No abnormal refraction was experienced in the Red Sea. Light winds and calms prevailed within 200 miles of the Gulf of Suez. Strong northerly winds prevailed throughout the length of the Gulf of Suez."

AN ANCIENT STEAM ENGINE

The closing up of an old dry dock at West Harbor, Greenock, brings into prominence the old pumping engine, which has been in use for the past 135 years, and is still in good working order. The graving dock was built by James Watt in 1785, and the engine was also built by him, and has been there ever since. The engine is fitted with the Watt governor for controlling speed by opening and closing the throttle, differing but slightly in design and nothing in principle from the throttle governors used today. The fact that Watt built the dock brings back to memory the fact that he was a civil engineer, and in that capacity built the first dry dock in Scotland, at Port Glasgow, in 1762, and the dock is still in use.

The General Survey of Engines and Boilers

This Article Deals in a Descriptive Manner With the Work Necessary to Put a Ship's Engine Through Lloyd's or Board of Trade Survey

By T. H. FENNER

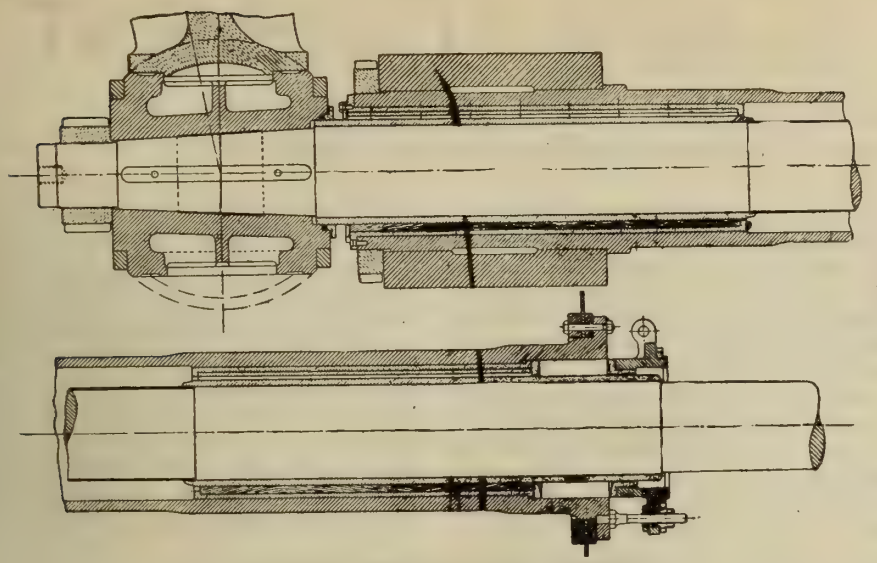
WE have dealt pretty well with all the work which would have to be gone through by the ship's engineers to comply with the requirements of a thorough survey, with the exception of perhaps one item. This, however, is a very important one, requiring much experience and skill on the part of the men in charge of the work, and frequently very hard labor on the part of everyone engaged on the job. The operation we refer to is that of taking in the tail-end shaft for examination of the liners, the shaft end, and the stern bushing. The ship has, of course, to be in dry dock when this job is done, and the opportunity is also taken to examine the sea connections on the ship's side at the same time. This, however, is not a very great matter as far as work is concerned, although it is, of course, important. The work consists in repacking the ship side blow-off cocks, and examining and regrinding if necessary the injection valve, sea connections to ballast pumps, etc. As the time a ship is kept in dry dock is limited to the least possible amount, these jobs are usually done by the men from the shore gang, under the supervision of the second engineer of the ship. It may be said here that any work that is done by shore staffs should be carefully overlooked and inspected by the ship's staff before the shore men leave it. This is necessary not because the men in the shore gang are not competent, but being human they are likely to take less trouble with the way the work is done than if they were going to sea in the ship. For instance, if a man is packing a feed check valve on the boiler front and he comes to the last turn of packing and finds he has barely enough to make a full turn, his actions are liable to be governed by whether he is going to be at sea with that gland or otherwise. If he is going to be at sea he will go to the stores and get some more packing, so as to complete the job in good workman-like fashion. If he is not going to sea with the ship and is inclined to be a bit careless, he will put in the incomplete turn and let it go at that. The result is that the gland screws down unevenly, or if screwed down even, presses harder on one part of the packing than another, which, of course, distorts the packing and soon renders it useless. That is only one instance, but there are plenty more.

The moral is, of course, for the second engineer or one of the ship's engineers to be everlastingly on the job and see that the work is done right. They will have to be tactful, of course, or else they will have the shore gang so antagonistic towards them that nothing will get done. The proper way if they see a man doing a job in a way they don't like is not to go to the man, but to go to the foreman of the shore gang, and make the complaint to him, and insist quietly, but firmly, that the job be done properly. There is usually not much difficulty in securing the assistance of the shore foreman, and it is well worth while. The time to do a job is when the ship is nicely tied up in dock and everything is cool, and there is reasonable time available. It is a different matter to do it at sea, with the engine room probably 110 to 120 degrees in the coolest spot, and everything that has to be touched at the temperature of the feed water or steam, with perhaps bad weather thrown in. However, we must get back to the tail-end shaft, which we started on to begin with.

After the ship is safely shored up and the water pumped out of the dock, work on the after-end of the shaft will be commenced. Work in the tunnel will already have been under way, preparing for the drawing in of the shaft when the propeller is off the shaft.

It is usual in most ships to fit what is known as the intermediate length of shafting, and this comes right next to the propeller or tail-end shaft itself. It is shorter than any of the other lengths of the tunnel shaft and is made that way so that it can be easily rolled out of the way after it is disconnected. Strong brackets of angle iron are made, so that they can be set across the tunnel under the shaft to carry the intermediate length after the coupling bolts are taken out, and the shaft rolled to one side. Removing this short length is the first job to be done preparatory to taking in the tail shaft. The next thing to be done is to take all the packing out of the stern gland, and block up the tail-end shaft from the coupling to the after bulkhead with solid square iron bars, so that it cannot move outward while the propellor is being removed. In the meantime the men in the dry dock have erected their scaffold, and a good solid stage to work on at the level of the propeller nut. Their first job is to remove the nut, which is usually a tedious job. Propeller nuts are usually made with a left-hand thread, so that the action of the propeller in turning tends to tighten the nut, instead of slackening it, which would be the case with a right-hand thread. If the propeller is a left-hand one the nut is threaded right-handed. The nut is usually round, and holes are provided round the circumference to allow a circular spanner with a projecting pin to fit in the holes. A tup or ram is slung from the stern and swung on the end of the spanner till the nut slacks off. It may be necessary to warm the nut up by means of a fire before it will start, though this is not always the case. Once it is started and moved two or three threads it can then be turned by taking two or three turns of a rope round the rim, and parbuckling or overhauling the end, thus turning it round. This is far easier than using the heavy spanner. Care must be taken as it comes off the thread to have it properly slung or have blocking ready for it to land on, it being a very heavy piece, not easily handled.

The nut having been backed off, the next job is to start the propeller. This is usually accomplished by means of wedges, driven in between the propeller boss and the stern frame. It is also necessary here at times to heat up the propeller, but care has to be exercised in doing this. In some propellers the boss is recessed out, only fitting the taper at the front and back, with a space in the centre. If by any means water has got in this recess and no means have been taken to drain it out applying a fire may mean bursting the boss. Starting a propeller is a job that requires patience, experience, and skill, and is not a job to be undertaken lightly, or without proper appliances. Once having got it started it is slung carefully so that it can be handled with ease in lowering it to the bottom of the dock. A tackle is usually rigged over the stern, and guy tackles from each side of the dock, so that it can be guided carefully. The propellor being slack, the men on the inside of the ship rig tackles round the tail-end shaft, fastened to eye bolts in the tunnel framing and haul in on the shaft till it is brought inside the tunnel. The brass liners can then be examined and the condition of the shaft at the end of the brass liner carefully noted. This is a part that is especially susceptible to corrosion by grooving, due to the galvanic action of the brass liner on the steel shaft in the presence of salt water. Here is a point that a great many people make a mistake in, and that is the purpose of the brass liners. They are not to prevent corrosion as is so often thought, but to provide a smooth working surface for the shaft. They are really a cause of corrosion. These grooves in the shaft are sometimes very deep and one method of preventing them



A TYPICAL STERN TUBE ARRANGEMENT

is to fit a hard rubber sleeve on the shaft between the end of the liner and the propellor boss to keep the water away from them. When the shaft is grooved there are various means of correcting it. The method usually employed is to turn the shaft down to the depth of the groove over the whole length between the end of the liner and the beginning of the taper. This is in accordance with a well-known engineering principle that there is less liability for a shaft to break if the small part is long than if it consists of a deep, narrow groove. If the grooves have got to a depth that would make the shaft too weak to carry the torsional stresses involved it must be replaced. It is not unusual for a ship to carry two tail-end shafts, and these are changed at the time of the examination about every two years. The reason of this is that a shaft constantly revolving in one direction gets strained, or fatigued, and a period of rest allows the molecules to come back to their former position. This is another illustration of the same principle which makes a razor better if it is laid up for a while, and it is also carried out in the manufacture of steel parts that are heat treated during the processes they go through. A period of seasoning will bring them back to shape if they are warped during the manufacturing processes.

The condition of the brass liners is also observed, chiefly for signs of wearing. If the vessel has been working in waters where there is a lot of sand, such as shallow rivers, these liners may be badly scored. The lignum vitate bushing in the extreme after end of the bush also comes in for examination as this is often found to be worn down considerably. If this is the case the strips of wood are renewed. Of late years it has been the practice to make this bushing of white metal instead of lignum vitae, and this has been found quite satisfactory.

For the benefit of those who may not be familiar with the construction of a stern tube we may say that this consists of a cast iron tube, which is fitted between the after bulkhead and the stern post of the ship to carry the propeller or tail-end shaft. It is fitted with either one or two brass bushings, according to whether the tube is long or short. If long there are usually two bushings, with a space between them. At the aftermost end a third bushing is fitted, either of strips of lignum vitae, or white metal as already stated. The inboard end, that is at the after bulkhead, is made with a flange and a recess is turned out to make a stuffing box. The flange is bolted up to the after bulkhead, and the stuffing box is packed with hemp packing, the gland and studs usually being made of gun metal. The tail-end shaft is fitted with gun metal liners to correspond with the bushings in the tube. The water can get in the tube from the after end, helping to lubricate the shaft and keep it cool, but the gland prevents the water leaking into the tunnel. It is usual at sea to allow the gland to leak slightly, this tending to keep the shaft cool at this point. A jet of water from the water service in the engine room is also made available here by a pipe and cock, which can be used if undue heating appears likely.

Some vessels never give trouble at this point, while others need continual watching. It may be said generally that if the shaft is in line the gland will run well, but if the shaft is down trouble is likely to be experienced.

The alignment of the tunnel shafting can be tested while the tail-end shaft is out by taking out the coupling bolts between different lengths, when it will be found, if the shaft is not in alignment, that the flanges will not face up fair, but show an opening either at the bottom or top, according to which way the shaft is lying in the bearings.

We believe that we have covered the ground in these series of articles fairly completely, and while there is nothing new in them for the seagoing engineer of experience, they should prove useful to the young man who has not yet started his seagoing career, or is in the early stages of it. Every seagoing engineer knows that when he made his first voyage to sea he practically started on a second apprenticeship, entirely different to the one he had already passed through. Where the apprentice has served his time in a shop that gave him opportunity to go on trial trips during his later years of apprenticeship he may have some knowledge of what his duties may be, but, generally speaking, it takes several years at sea before a man becomes a real capable, all-round engineer, such as is the pride of the British merchant service.

TAPPING SOFT METALS

In tapping soft metals such as aluminum, there is quite often some difficulty in starting the thread, as the tap will at first either ream out the hole in a partial manner or strip the thread after it is started.

Both these dangers can be avoided, and perhaps the simplest method of all is to make an accurately threaded guide block about the same depth as an ordinary nut.

By placing this guide block in correct position over the hole to be tapped, no trouble will be experienced as the tap must then travel through the soft metal at a predetermined rate. Of course the guide block must be clamped to the work. It is essential that the block be fastened, and another point to be watched is the use of a good lubricant.

Whenever dealing with soft metals, do not rush the job. Humor it, for owing to the weakness of the metal it is likely to break away if too much force is used. Even copper can be stripped if two much force is adopted. If cutting threads on the lathe the danger is not so great but even there it is necessary to use the best of care. Above all see that the cutting tools are sharp. If you don't the results will be far from perfect.

Some recent tests to determine the proper amount of air required for special thermit welding gasoline and compressed air preheaters showed that 25 pounds per square inch seems to be a practical minimum. At this pressure, a single burner preheater will require approximately 25 cubic feet of free air per minute and a double burner preheater approximately 50 cubic feet. For very large welds, where the walls of the molds are thick and the preheater gates longer than usual, a pressure of 40 pounds per square inch would be advisable. This would require approximately 35 cubic feet of free air per minute for a single burner and 70 cubic feet of free per minute for a double burner.

PROGRESS IN NEW EQUIPMENT

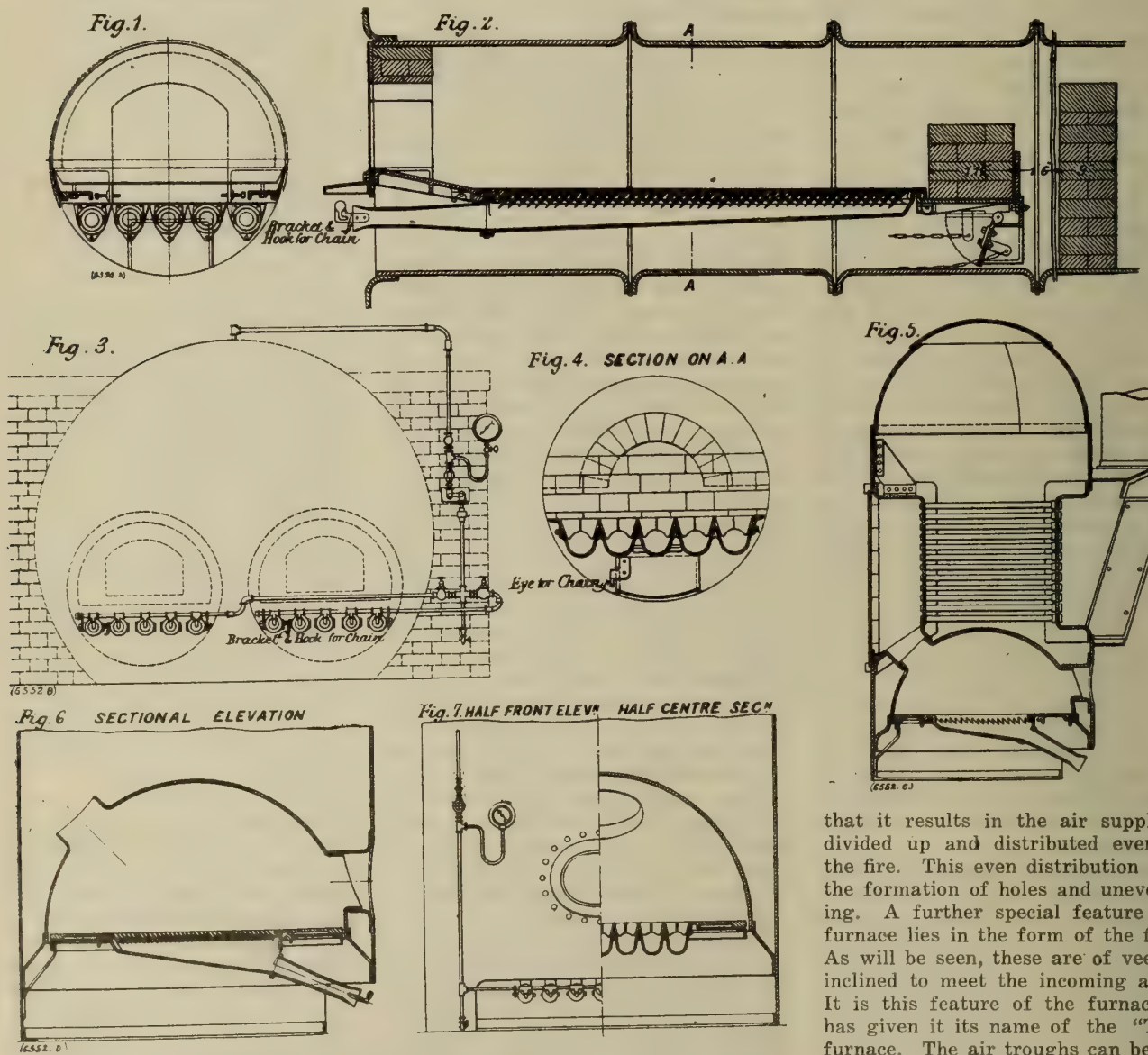
There is Here Provided in Compact Form a Monthly Compendium of Shipbuilding and Marine Engineering Auxiliary Product Achievement

THE TURBINE FURNACE

The following interesting description of a new type of furnace is taken from the pages of Engineering (London). This should be of interest to steam users on this side of the Atlantic, where fuel has reached unheard of prices, and seems inclined to stay there.

The present fuel situation and the fact that there are no indications of any important fall in the cost of fuel in the future renders any appliances for utilizing the cheaper, or poorer, grades of great importance. Much has, of course, been done in various directions to accomplish this, but in many cases expensive reconstruction work is necessary before the appliances can be utilized, so that the ease with which it can be installed would appear to be not the least valuable of the features of the furnace which has been brought out by the Turbine Furnace Company, Limited, of 5, Budgerow, London, E.C. 4. The appliance has other important qualifications, however, as will appear in the course of this description. For the moment it may briefly be said that it will efficiently burn almost anything which can be described as fuel; coke breeze, slurry, small slack, cinders and similar poor fuels are being successfully utilized in many boilers to which the furnace has been fitted.

The details of the furnace will be clearly followed from Figs. 1 to 4, above, which show an installation applied to a Lancashire boiler. This arrangement consists of a series of troughs which lie side by side, and form the base of the furnace. These troughs carry the fire-bars. As will be seen from Fig. 2, the troughs have a cross-sectional area diminishing from the front to the back. The way they nest side by side is best shown in Fig. 4. The front of each trough forms an air injector and is fitted with a steam jet. This arrangement of troughs forms one of the special features of the furnace, and it will be clear that it results in the air supply being divided up and distributed evenly over the fire. This even distribution prevents the formation of holes and uneven burning. A further special feature of the furnace lies in the form of the fire-bars. As will be seen, these are of vee section inclined to meet the incoming air blast. It is this feature of the furnace which has given it its name of the "Turbine" furnace. The air troughs can be likened to the nozzle and the fire-bars to the blades of an impulse turbine, and it will be evident that some approach to a stream-line flow of the air from the injector up through the fire will be obtained. The arrangement should certainly cut down resistance and economize the



APPLICATIONS OF THE TURBINE FURNACE

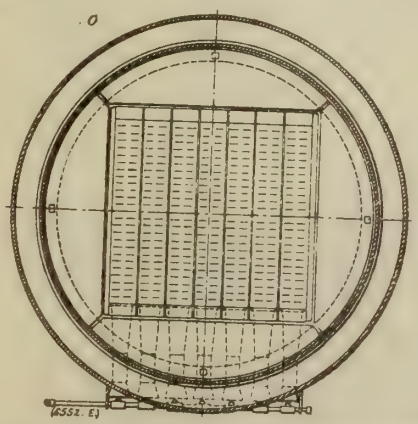
expenditure of energy in the steam jets, and the performance of the furnace in numerous installations would appear to show the arrangement to be a very satisfactory and efficient one.

The fact that the division of the incoming air through the series of troughs breaks it up and ensures a uniform supply to all parts of the fire has already been referred to. The uniform distribution which is obtained, however, also owes much to the gradually diminishing section of the troughs and the shape of the fire-bars. The overall result of the arrangement would appear to be a uniform air pressure below and throughout the whole of the furnace. The uniformity can be well seen if a thin fire is maintained, when an even burning with an absence of holes is obtained. These special air-flow arrangements naturally tend to keep down the power required from the steam jets, and as a result a small jet only is necessary. The nozzles are of gunmetal with holes something less than 3-32 inch diameter. The holes are formed with a square shoulder near the entrant end with the result that considerable contraction is obtained, and a jet of considerably smaller diameter than the hole issues from the nozzle. To further economize the consumption in the jets the steam is superheated before being carried to them. This decreases the density and so decreases the quantity of steam used.

It is not necessary to say anything in great detail about the mechanical construction of the furnace, as its features are well shown in the illustrations. It may be stated, however, that the whole arrangement is self-contained and sits in the boiler flue without any drilling for bolts, or rivets, being necessary. As will be seen, front and back castings are provided on which the air troughs hang. The troughs are of uniform width, and in the cases of flues of greater, or less, diameter, more, or fewer, troughs are fitted. The fire-bars are comparatively small castings, and each holds the one immediately behind it in place. A special locking bar is used at the front end. The superheater is a simple U-tube arrangement fixed in the flue to one side of the boiler. Its position together with the run of the steam connections to the jets are clearly shown in Fig. 3. In many Lancashire boilers no great degree of superheat will be obtained with this arrangement, but the steam will be dried and its density lowered, which is the object aimed at.

A further point which should be mentioned is that the grate is set somewhat lower than is usual. The dead plate at the front of the furnace has a downward slope to allow of this. The idea of this arrangement is to increase the combustion space. Other details are the two firebrick bridges and the cleaning door operated by a chain, all of which are shown in the figures. In operation, the steam jets may, of course, be regulated to suit the fuel or the conditions of any natural draught arrangements which may be fitted. There is no tendency for the forced draught to return through the flue door, and this door may be opened at any time without the steam jets having to be attended to in any way. Owing to the form of the bars and the distribution of the draught very small fuel may be burned without choking of the bars. Very little ash makes its way through into the troughs, and what does can be removed without difficulty with a half-round scoop. An installation of the furnace applied to a Cochran boiler is illustrated in Figs. 5 to 8. These are of interest as showing the adaptability of the furnace, but it is not necessary to refer to them in detail as the arrangements are well shown in the figures.

This furnace was, we believe, introduced very shortly before the outbreak of the war, and from that time up to the present we understand some 600 equip-



TURBINE FURNACE IN COCHRANE BOILER

ments have been installed. This rapid advance during a period of difficulty may, no doubt, partly be explained by the ease with which the furnace may be installed and its adaptability to a wide range of fuels. In some cases an entirely satisfactory boiler plant has been dependent on supplies of a particular grade of coal. Such a state of affairs was a workable one before the war, but in the new conditions which have now arisen it has become necessary to burn fuels of poor quality or of widely differing grade, and a device such as the "Turbine" furnace is of great value. We may say that a boiler fitted with a "Turbine" furnace is employed by the Gas Light and Coke Company for the purpose of testing the steam-raising powers of various fuels. As an example of the operation of the furnace we may quote the results of a test taken by the General Electric Company, Limited, at Birmingham. The test was carried out on Galloway boilers, 28 feet long by 7 feet 6 inches diameter. An economizer was fitted, and there was a chimney 120 feet high. Midland slack of a calorific value of 9,076 British thermal units was burned. A comparative test with ordinary fire-bars and the "Turbine" furnace was made. The test extended over 6 hours and during that time the "Turbine" furnace burned 9,034 pounds of fuel against 6,272 pounds in the ordinary furnace. It evaporated 50,800 pounds of water against 25,800 pounds, giving a result of 4.34 pounds of water from and at 212 deg. F. for the ordinary furnace and 6 for the "Turbine" furnace.

A NEW COMPENSATED HEAT-METER

Until comparatively recently, the determination of furnace and kiln temperatures by means of thermocouples was attended with complications and difficulties which made practical men impatient, and in some instances doubtful in regard to the intrinsic value and reliability of the method.

Technical men, however, have realized from the beginning that, within certain temperature limitations, the results obtained by the use of thermocouples were not only accurate, but could be made "direct reading," provided that the thermocouple be connected with a galvanometer which would indicate the actual value of the e.m.f. obtained by heating.

On first consideration, this problem did not seem difficult of solution, since it is an established fact that the e.m.f. or voltage of a thermocouple bears a direct relation to the difference in temperature between its hot and cold ends. It is also true that the movable coil of a millivoltmeter will be deflected to an extent which is directly proportional to the e.m.f. of the thermocouple. Therefore it would seem the simplest operation imaginable to connect the thermocouple and the instrument together by means of insulated conductors, figure the scale in temperature values and regard the problem as solved.

Unfortunately, however, we have also to contend with factors which cannot be ignored if accurate results are required; namely, line resistance, thermocouple resistance, and the resistance of the indicator itself, because, to be precise, a direct current millivoltmeter actually is not a millivoltmeter at all, except in name, but is a milliameter or current indicator. All instruments of the d'Arsonval type depend primarily upon current for their operation and the extent of the deflection obtained with any given current is established by the intensity of the magnetic field, the controlling force of the springs, and the number of convolutions or ampere turns in the movable coil, and not by a remote e.m.f. Therefore, if the conductors which carry the current from the source of e.m.f. to the terminals of the instrument do not have a negligible resistance, then, in accordance with Ohms' law there will be an appreciable fall of potential along the line, with the result that the movable system will receive a diminished current and therefore be low in its readings. To reduce such errors to a minimum, it is desirable that the instrument resistance be as high as possible, so that the line and thermocouple resistant may be proportionately

insignificant. For instance, if the resistance of the millivoltmeter is 300 ohms, and the resistance of the line (A) and thermocouple (C) is 3 ohms, the current through the circuit will be reduced ½ of 1 per cent. instead of 1 per cent., and the instrument indications will be 1 per cent. low. Figured in degrees Fahrenheit, this would mean an error of approximately 14 deg. in 1400 degs. Fahr. if a thermocouple were used.

The advantage of high-resistance instruments, therefore, becomes evident. For instance, if the pyrometer has a resistance of 600 instead of 300 ohms, and the line resistance remains the same, an error of 3 parts in 600 will result or only ½ to 1 per cent. instead of 1 per cent., or about 7 deg. Fahr. in 1400 deg. Fahr.

Until within the last five years it was customary to use a so-called low resistance pyrometer to measure the current from the thermocouple. These instruments had from 2 to 5 ohms internal resistance and were naturally materially affected by the external resistance of the thermocouple and leads. In the past few years high-resistance pyrometers have been almost universally adopted. These instruments have an internal resistance of usually from 300 to 1200 ohms. The higher the resistance naturally the less effect on the readings due to variations in line resistance, but will increase in internal resistance; something has to be sacrificed, and usually control or torque is weakened. In consequence, the instrument is not as substantial or dead-beat, and, due to the use of lighter springs, is more apt to be affected by spring fatigue.

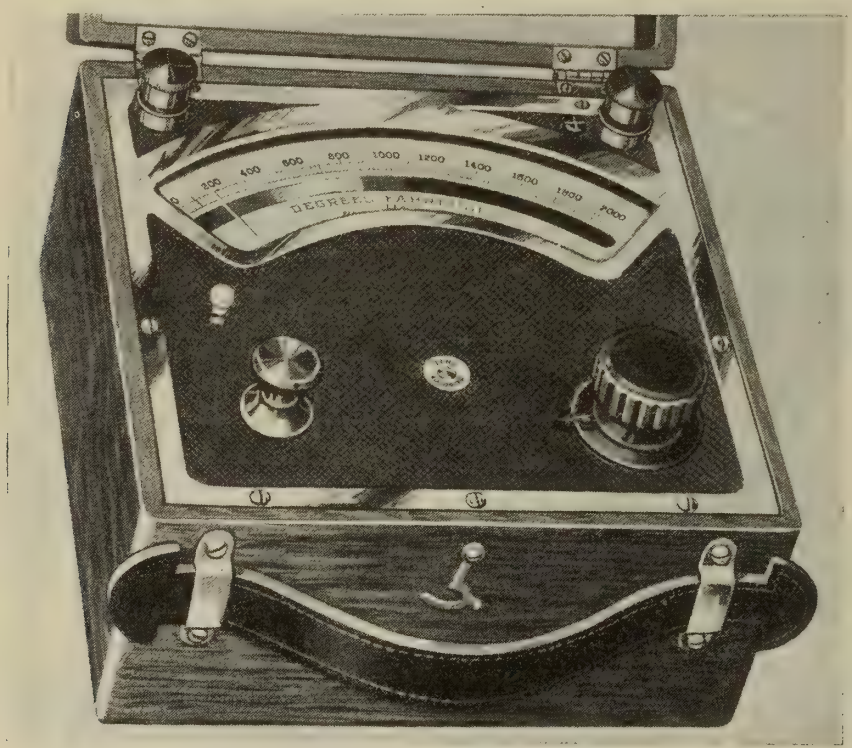
It has been found by trial that an instrument of medium resistance (about 300 ohms) can be produced in a satisfactory and substantial form, but an instrument of this class is necessarily affected in its indications when leads of considerable length are employed. Material variations in the length of thermocouples are also a source of error, as well as the introduction of compensating leads. When compensating leads are employed, as well as long wires, in connecting the thermocouple with the instrument, it is a common practice to reduce the resistance of the instrument in order to offset the effect of line resistance. This is at best a method of doubtful value, since it interferes with checking the scale by comparison with a standard, and does not compensate for changes in the resistance of the line or thermocouple, due to variations in temperature.

Various devices and attachments have been made for use in connection with indicating and recording millivoltmeters and pyrometers, by means of which the instruments will remain direct reading, and at the same time be compensated for external or line resistance. Inventions of this class range all the way from a simple step rheostat connected in series with the "dead" resistor of the instrument, to the elaborate and complicated apparatus employing the substitution and deflection methods, the potential of the thermocouple being first balanced against another potential derived from a dry cell, and after an intermediate operation and on intercomparison of deflections, the effect of line resistance is finally balanced out by means of a rheostat, and direct deflections are obtained from the thermocouple current.

It remained for two physicians, Paul D. Foote and T. R. Harrison, of the Bureau of Standards, Washington, to offer an invention of theirs, which, incorporated in a Brown pyrometer, eliminates the effect of line and thermocouple resistance by means of an operation which is so simple that anybody can use the instrument and obtain accurate results.

This improved heatmeter will unquestionably appeal to the practical man who wants results and does not care especially how the instrument functions provided its indications can be relied upon.

In testing with this apparatus all that is necessary is to connect the thermocouple with the instrument binding posts in the usual manner, press a button, turn a knob, and take a reading, which will be the correct e.m.f. of the thermocouple at its hot end, even if the line is miles in length. In fact the line may have as much as 15 ohms resistance. The Brown Instrument Company, Philadelphia, are the manufacturers of this equipment, and the accompanying illustration shows one form of the complete instrument. As will be seen, the accessory details incorporated into the instrument do not decrease its portability and convenience nor increase its size.

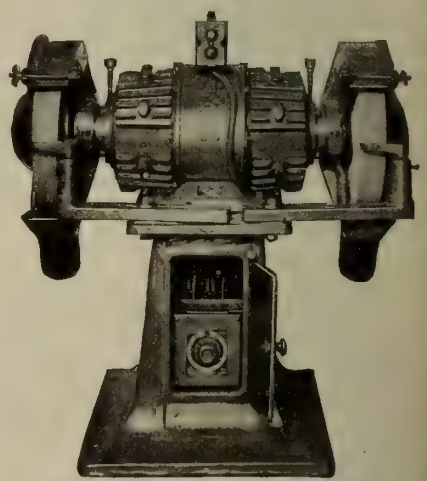


GENERAL VIEW OF THE HEATMETER.

SELF-CONTAINED GRINDING MACHINE

The U. S. Tool Co., Cincinnati, Ohio, has recently placed on the market the self-contained tool-grinding machine shown in the illustration, ease of starting and total enclosure of the motor and control apparatus being features claimed by the maker.

The machine is equipped with a 5 h.p. shunt-wound, adjustable-speed Westinghouse motor running at from 1,120 to 1,600 r.p.m. on 230-volt direct current. The motor is started and stopped by a push button that controls a type C Westinghouse starter equipped with a speed-adjusting rheostat and located in the base of the machine. The push button is mounted on the top of the motor so that the workmen will not start the motor by jabbing the button with the material which they intend to grind, since it is easier to operate it by hand.



GENERAL VIEW OF THE GRINDER.

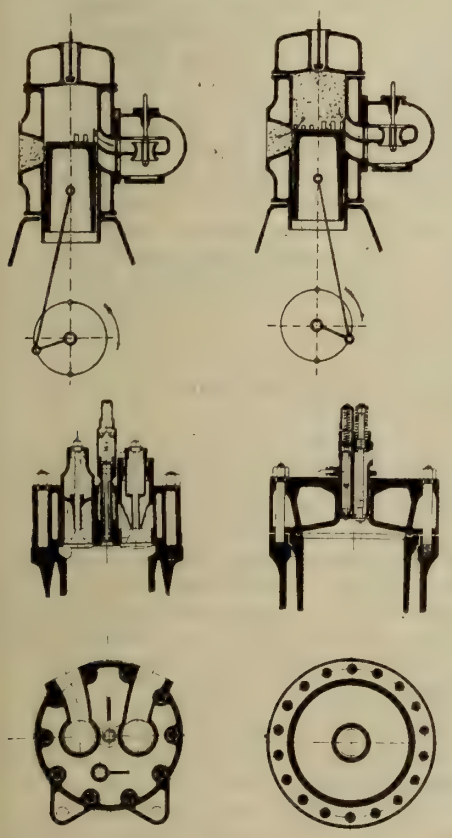
H. L. Peiler, manager of the Mason Regulator Company, has just returned from a very successful business trip in the Eastern Provinces.

A NEW MARINE DIESEL ENGINE

All matters connected with the rapid production of merchant shipping are now of vital interest to the manufacturer whose trade development is hampered by lack of export facilities, and British engineers who endeavor to remedy the present shortage are assured of hearty support.

The development of the marine Diesel engine will undoubtedly prove an important factor in easing the present situation, as boats equipped with machinery of this class have far more cargo capacity, weight for weight, than vessels driven by means of steam turbines or reciprocating engines, in addition to a greatly increased radius of action.

Realizing the great future of the Diesel engine for ship propulsion, Messrs Armstrong Whitworth have entered into an agreement with the well known Swiss firm of Sulzer Bros., whereby they acquire a license to manufacture and sell, in Great Britain and the colonies, two cycle marine engines, embodying the best features of the Sulzer system.



THE TOP FIGURES SHOW THE SULZER ARRANGEMENT, WHILE THE LOWER SHOWS DIFFERENCE OF HEADS ON THE TWO AND FOUR CYCLE TYPE.

It has been decided to adopt the two cycle principle on account of the proved reliability and efficiency of this type of engine, its high ratio of horse power to size and weight and its ability to work continuously on Californian or Mexican crude oils of high sulphur and ashphalt content, which are the cheapest fuels at present on the market.

Engines aggregating over 600,000 B. H. P. have now been built by Sulzer Bros. on the two cycle principle, and the experience they have gained in regard to both design and manufacture will be placed at the disposal of Armstrongs in the production of the new engine.

The Sulzer system is shown on the accompanying diagram, and a two cycle cylinder head compared to a four cycle.

TWO SPINDLE DRILL

The Black & Decker Mfg. Co., of Towson Heights, Baltimore, Md., has recently designed a two-spindle drill, specifically adapted for drilling holes necessary for the Murphy top fastener. This fastener is used for attaching automobile side curtains and when the base of the fastener is put on the automobile body, two holes ⅞ inch apart are necessary. This new machine drills these two holes the correct distance apart in the same operation.

The handle of the drill is like an automatic pistol and a pull on the trigger sets the two drill bits in motion. A second pull stops the drill and in this way the operator can control the tool without changing the position of either hand. The motor and the gear construction necessary for driving the two spindles is simple but rugged. The gears themselves are of the finest grade steel, heat treated. The two spindles have specially designed chucks to hold the two ⅛ inch drill bits.

GENERAL VIEW OF TWO-SPINDLE DRILL.

The tool is exceptionally light and by holding it in the natural way with the forefinger on the trigger the operator is able to drill two holes at the same time ⅛ inch in diameter and ⅞ inch apart.

COMBINATION DRILL AND REAMER

A tool that has been specially designed for use on jig work has been brought out by the Fastfeed Drill and Tool Company of New York City. This is a combination drill and reamer made of high-speed steel. The drill size is made about .010 to .015 inch below that of the reamer which is the desired size of the hole. The tool has four blades and they may be sharpened on the front edge as in the ordinary reamer. It is claimed that a high rate of production can be maintained with these tools. These tools can be obtained with shanks to fit any existing equipment.

Loveridge, Ltd., Cardiff, S. W., have issued a new catalogue covering their various marine lines, which include their well known wood and iron pulley blocks, snatch blocks, gins, etc. Differential pulley chain blocks, hoisting crabs, jacks, hand capstans and practically all varieties of bo's'n's stores are included. The requisites of the galley, fresh water pumps, brass steam fittings, etc., make the catalogue of interest to the engineering side of the ship.

Detroit.—The grain fleet led by the John J. Sullivan, reached Detroit safely on Dec. 17th and left for Buffalo. They are the last boats to make the trip before the close of navigation, and they numbered eleven. The vessels were more or less covered in ice and snow, but reported very fair weather for the time of year in their trip down.

Sault Ste. Marie.—There is evidently no chance of salving the steamer Francis Widlar, which went ashore recently on the Pancake Shoals. The wrecking tug which returned to the Soo reports that the vessel has broken her back, and in addition to this her stern is badly twisted.

Power for London.—The Ontario Power Commission has approved of plans for a Hydro Sub-station in East London to cost $35,000, to accommodate the new industrial area that the city has established there. Work will begin at the first of the new year and filtration equipment will also be installed at the Horton street pumping station at a cost of $55,000.

Ready to Operate.—The new industrial plant of Machinery and Foundries, Ltd., Brockville, Ont., is almost ready for operation. General foundry and machine products will be turned out and special attention will be paid to the manufacture of power and hand pumps. The cost of the construction of the plant will be about $75,000.

Fuel for West.—It is reported by the Bureau of Research, Ottawa, that lignite briquets are being turned out at Estevan, Sask., which are equal to anthracite coal and will be sold at half the price or less. The plant is maintained by the Dominion, Saskatchewan and Manitoba governments and can turn out 50,000 tons per year.

Will Develop Plant.—It has been reported that the United States Steel Corp. has voted $291,420 for the extension of the Essex Terminal Railway for running several spurs from the main line of the route into the plant of its subsidiary, the Canadian Steel Corporation

MARINE ENGINEERING
OF CANADA

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The Year's Work

THE past twelve months have been eventful ones in the shipbuilding industry of Canada and have unfortunately been marked by several failures among those engaged in it. Various causes have been responsible for these casualties, high material and labor costs being probably the chief of these. The large building programme of the Dominion Government is rapidly approaching completion, and the past year saw the finish of the last of the Imperial Munition Board building. Prospects for the coming year are at the present none too bright, but there is a general feeling that if the yards can tide over the present period of high exchange which militates against the securing of export orders, the yards still in business will be able to continue a profitable existence. The personnel of the yards has become more efficient and costs have come down to a point where the cost per ton of building a ship is very little higher than in Great Britain. The present time is a dull one for shipbuilding in most countries, as owners are none too keen about building under the circumstances as they exist at the moment. It must be remembered, however, that although the tonnage in existence is more than it was in 1914, the normal increase has not taken place and if the world was producing at its normal rate, there would still be a shortage of tonnage to carry the products of the different countries from one to the other. Careful management and a little judicious help from the Government should be sufficient to tide over the hard times and place the industry on a basis of permanency and profitable production.

The Toll of the Lakes

THE statistics for the casualties on the lakes for the year ending June 30 last provide interesting reading. The total number of casualties were 132 and the loss of life was 69. This is a large number, though the proportion of lives lost to the total number of men engaged on the lakes is small. People do not always realize that the traffic on the Great Lakes is larger than on any other marine highway of the world, and it is said that during the season no less than one large freighter passes a certain spot every six minutes. The property loss amounted to $2,300,850, and the total property value involved was $38,672,415. The persons aboard the vessels numbered 4402 of whom 3231 were members of the crew. The total tonnage of the vessels which came to grief was 397,585, and this was more than three times the tonnage involved in casualties on the Pacific coast. The present season seems to have closed with remarkably few casualties, the absence of any very violent gales being the probable reason. The United States Government are taking measures to make things safer for lake navigators by putting up a chain of wireless stations at various points, which will send out messages tuned to capable of being caught by any vessel which carries wireless. There will be eleven of these stations in all, and they should be capable of rendering great assistance to storm bound and storm caught vessels. Navigating vessels on the lakes is not the sinecure it would appear to be to those who are not conversant with its problems, and in view of the enormous value of the property involved, safety measures are well worth all the money that can be usefully put into them.

The Toronto Shipbuilders

A PECULIAR situation has arisen in Toronto with regard to the renewed activities at the Dominion Shipbuilding & Repairing Co. When the yard closed down work had been started on two ships for the Canadian Government Merchant Marine, and the Government was approached later with the proposition to continue work on them until completed, to give work to the otherwise workless men, of whom there are a great number in Toronto at the present time. The Marine Department consented, and awarded the completion of the work to the Collingwood Shipbuilding Co. of Collingwood. With the opening of the yard trouble immediately arose, the labor men claiming that the contracting company were bringing outside men to work on the job, and that they were endeavouring to cut the union scale of wages. The men are evidently of the opinion that no bread is better than half a loaf. To the man in the street it would appear that even if the same scale of wages which the liquidator of the Dominion Shipbuilding & Repairing Co. claims was responsible for its assignation was not to be had, work at slightly less wages would be better for an unemployed man than no work at all. At the present time, when shipbuilding in Canada is in a very doubtful position, it would hardly seem the time for labor to demand its pound of flesh. We hope for the good of all concerned that organized labor will be able to come to some agreement, so that the work, which will employ a large number of men through the dull winter season, may be speedily got under weigh. This time of the year should be favorable to a spirit of compromise if that has not altogether disappeared from our midst.

News of The Shipping World

SHIPBUILDING in Great Britain is still suffering from the policy of ca' canny, and nearly every large vessel launched recently has been late in delivery and has cost considerably more than it was ever expected she would. Not only this, but a very large amount of repair work, which was a very valuable feature of the activities of many yards, is being lost to the country through this very same thing. Shipowners and underwriters find that they can get repairs made much more cheaply and expeditiously in Holland and Belgium than they can on the Tyne or Clyde, and they are sending the vessels there instead of to the latter ports. The Tyne especially was always a great centre for repair work and it is a thousand pities that such a condition should have arisen. One wonders how men can be so blind to their own interests as this policy shows them to be, and especially the British tradesmen, who are usually possessed of a very large measure of common-sense. However, the condition exists, and is doing untold harm to the industry. In this connection, Sir William Forwood, one of the directors of the Cunard Company, speaking at the launch recently of the Cunarder "Samaria," said that the ship should have been in commission six months earlier and that her cost would be probably £250,000 higher than was estimated when she was laid down. He declared that the men, although they were paid for eight hours' work, did not deliver more than five or six and in this he was borne out by Sir George Carter, the manager of Cammell-Laird's, the builders. It is to be hoped that the men will take heed of the results of their mistaken ideas before it is too late.

* * *

SIR KENNETH ANDERSON, chairman of the Orient Steam Navigation Company, speaking at the annual meeting of the line, had some interesting remarks to make on the subject of passenger rates. It is of course well-known that contrary to the freight rates, passenger rates show no signs of coming down, but on the other hand have increased considerably lately. As far as the Orient line was concerned, Sir Kenneth said that although costs of new construction and operating were still more than three times those of pre-war days, the ratio of advance in their saloon rates was much less than this, and in fact was much lower than the charge on other ocean routes. On top of this, shipowners were confronted with the demand of the sea-going staffs for an eight-hour day. This would mean, in a passenger ship of 16,000 tons, an increase in working costs of about $35,000 per month. This would mean that fares would have to be put on a level that would make traveling almost prohibitive, or else accommodation and service would have to be reduced to a standard far below that in force to-day. The strange thing about the passenger trade is that the demand for space is just as heavy, in spite of the high rates. This condition is similar to that prevailing on the railroads in this country.

* * *

THE indiscriminate rush to convert vessels from coal to oil burners has been the occasion of a warning from Lord Pirrie, who has been investigating the oil fuel position in the United States. Lord Pirrie states that the danger of a shortage is so real that it is quite probable that the U.S. Government will decide to place restrictions on the use of oil as a fuel for boilers on steam vessels. The only vessels that in future will be able to rely on regular supplies of oil fuel, in his opinion, will be the large liner class. In the further development of the internal combustion engine there is a great field, but the technical problems involved are so great that as far as high-powered vessels are concerned the solution of the many difficulties will be a long time coming.

THE Marine Department has decided to go ahead with the work of completing the two vessels on the stocks of the Dominion Shipbuilding & Repairing Co., which recently went into liquidation. The contract has been given to the Collingwood Shipbuilding Co. and work will probably have been started by the time this in in print. The work of building the boilers has been awarded to the John Inglis Co., of Toronto. This decision comes at a very opportune time, when Toronto has so many men unemployed, as it will require about 1,000 men for several months to complete the work.

* * *

AN item in some of the daily papers recently said that the Canadian Government Merchant Marine were considering the changing of the house flag of the line, the reason being that foreign sailors called it the rat line. We hardly think that such a reason would be sufficient to cause such action by the management of the Government fleet, who have shown themselves to be pretty level-headed. Canada, not being a maritime nation, the general public are probably not aware that it is the time-honored custom of the sailor to give some totally different meaning to the insignia of the company's house flag to that intended by the owner. Some of these nicknames were much more insulting than the one complained of by the Canadian newspapers. For instance, one well-known line of sailing ships out of Liverpool, now succeeded by steamers with the same house flag, had a flag which contained a cross, to the base of which were five links of a chain. What the meaning was intended for we do not know, but the sailors used to call it the iron cross of starvation and the five links of slavery. Another line, which flew the initials of the firm in the house flag, thus P. G. & Co. had these initials translated to mean "Poverty and Grief." The British & African Royal Mail Steamship Co.'s ships are known on the Mersey by no other name than the "monkey boats." We used to be familiar with a good many more of these nicknames, but memory fails us now. However, we never heard of any of the owners considering changing their house flag or line names on account of the irreverence of sailor men.

* * *

WE note in connection with the wholesale desertions of seamen from British ships in United States ports, which have been so much in evidence of late, that a Glasgow magistrate inflicted a very salutary penalty on a couple of these delinquents. The men in question were firemen, who deserted the steamer "Cloutsham" in the port of New Orleans, and subsequently returned to the United Kingdom on another vessel. They were sentenced to have their wages forfeited on the ship from which they deserted, and also on the ship on which they returned, and also were condemned to pay the expenses of the trial. This sentence should have a restraining effect on others who want to desert to American vessels for the higher pay obtained.

* * *

TALES of scuttling ships and such like wicked deeds, are called to mind by an enquiry recently made into the stranding of a steamer called the "Glendalough." The vessel went ashore on the Irish coast in March last, and the court of investigation has handed down its decision recently. The court finds that the vessel was lost due to the wilful act of the master, acting in concert with the managing owner, and in furtherance of a conspiracy with the managing owner. The court ordered the manager to pay £2,500 towards the expenses of the Board of Trade, and £1,500 to the underwriters. The master's certificate was cancelled, which eliminates him from any further possibility of command. It may well be that his seafaring career

as anything but a seaman or quartermaster is concluded, as underwriters have a long memory for things of this kind. These cases are very rare, the penalties for the offence being very heavy. We remember a case of a delinquent skipper who had kept away from the British Islands, following a case of this sort, for over twenty years and was arrested within two days of his landing. We met some years ago, in the Dutch East Indies, another shipper who was earning a living as foreman for a Chinese stevedore, he being unable to return to his home on account of some crooked work in connection with the loss of his ship. These men deserve the utmost punishment they can be given, as they are a blot on a profession which breeds about as high a type of man as can be found. The poetic justice which overtook the skipper in Victor Hugo's "Toilers of the Sea" was a punishment worthy of the crime.

The affairs of the United States Shipping Board, as told before the investigating committee, furnish wonderful evidence of Governmental mismanagement. Here we see a nation creating at a most enormous cost a huge fleet. To manage this fleet they appoint a board of men who know but little of ships or their operation, and place at their head a truculent fire-eating naval man. The experiment has cost the United States up to the present something over $2,000,000,000 and the end is by no means yet. Some of the details are hard to credit. For instance, oil was being supplied to the ships by both the Board and the open market. The Board was supplying 60 per cent. of the ships with oil at from $2.07 to $2.20 per barrel, while the remaining 40 per cent. were paying from $4 to $10 a barrel. The director of operations was blissfully ignorant of these facts. A trifling matter of $240,000,000 in securities was found, after a diligent search, in the safety vault where it had been deposited. There was no record of it in the hands of the Board. In fact, the financial affairs of the Board were conducted without leaving any accounting record. There have been, of course, wild stores of graft. We do not think there has been anything of this nature in the Board itself, though of course there may have been lower down. It is just a case of blindly going into an enormous undertaking without having the necessary qualifications to carry it on successfully. The God of Efficiency, whose home is popularly supposed to be the U.S.A., must have had some rude shocks of late.

THE White Star liner "Megantic" brought over on her last trip a number of coal miners from the Welsh Collieries, who are going to the mines in Nova Scotia. They are nearly all ex-service men and we understand, were granted free passage. Free passage will also be granted to their wives and families if the men are satisfied with conditions in the Nova Scotia mines.

* * *

AT the annual meeting of the Halifax Shipyards held on December 14th, a more cheerful note was sounded than has been the case recently in the shipbuilding industry. The year's operations had resulted in a substantial surplus. During the year the company had launched the "Canadian Signaller," an 8,500-ton vessel for the Canadian Government Merchant Marine, and a second ship of the same size is due to be launched this month. Following this, the two 10,500 steamers for the same owners would be completed, work having been in progress on them for some time. An important part of the yard's activities consisted in repair work, of which they had a large volume in hand. In addition to this, the president stated that they had almost completed negotiations for the building of five tankers and if they were successful in securing these orders, the work would be sufficient to keep the Halifax, Levis and Three Rivers yards busy for some time to come. The Board for the coming year will be: Horace B. Smith, president; J. F. M. Stewart and M. J. Haney, vice-presidents; Fred Pearson, R. M. Wolvin, J. W. Norcross, F. S. Isard, W. E. Burke and J. Norris, directors.

The freight market shows a considerable decline and is very weak in all quarters. Many shipowners are debating the advisability of laying up some of their tonnage. This, of course, would not be done if they had any prospect of keeping them going. In most markets the tonnage offering is away above the demand and this is specially noticeable in the outward coal markets from Great Britain to Continent, and from United States to Continent. The United States Shipping Board has so many vessels offering that they have had a bad influence on the market. Time charters have shown more activity, but the rates remain low.

Converted Gunboats

As an example of what is involved in the reconstruction of war material for peace time uses, the conversion of a number of gun-boats into cargo vessels, at present proceeding at Thornycroft's Southampton yards, is full of interest and inspiration, states the officer-in-charge of the Toronto office of the Department of Overseas Trade.

The boats undergoing reconstruction are a special type of patrol boat known as the "Kil" boats, so called from the first syllable of their names, "Kildonan," "Kilfinny,' 'etc. A number of these were recently purchased and slight alterations made to fit them for commercial work. It was later, however, decided to conduct more extensive alterations, including lengthening, so as to increase their cargo capacity.

Dry docks and slipways are being used for carrying out the alterations necessary. The first operation, conducted as soon as the vessel is placed on the slipway or dry dock, is to divide it in two. This operation is perfomed by knocking out the rivets uniting the shell plates and keel, no actual cuting being necessary. One half of the vessel is then drawn apart a distance of 43 feet. Considerable care is required in carrying out this operation so as to secure that the two halves of the vessel are in exact alignment so that a new portion may be built between the separated halves. The greatest difficulty in securing such alignment is found in the case of vessels being reconstructed on the slips, as the two ends tend to settle down unequally. To secure complete adjustment hydraulic jacks are employed. These operations successfully performed, little difficulty is found in actually building in the new section.

Additional hold space is also created by removing one of the two boilers and a cross bunker with which the vessels are fitted. In the place of the removed boiler a vertitcal Cochrane donkey boiler is installed.

More work, though less striking and sensational, is involved in the internal rebuilding, than in the operations described above. The elimination of two cross coal-bunkers, and the forward shift of the bulk-head between the two foremost holds necessitates considerable attention.

Other alterations such as the building up of the forecastle, the building of a turtle-back steel deck-house over the wheel, etc., completely change the appearance of the vessels from ships of war to tramp steamers.

As reconstructed these vessels have a length of 213½ ft.: breadth, 29 ft. 10 in.; depth, 16½ ft.; load draught, about 14 ft. 4½ in.; load deadweight, 950 to 1,000 tons, displacement at above draught, 1,620 tons; speed, 10 knots. (A speed of 11.6 knots per hour was attained on trials.)

The vessels have three holds with a combined capacity of 45,000 cub. ft., an increase of about 50 per cent. in carrying capacity.

The total time taken in carrying out the reconstruction of one of these boats, the "Kildonian," was 75 days.

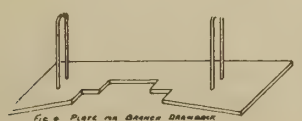
Dealing with shippinig matters generally the officer in charge added that the freight markets have generally been largely overshadowed by the coal crisis, and although other factors, such as the commencement, or imminence, of the movement of world's crops, which, on the whole, are good, tend to impart a very steady undertone, the above uncertainty renders inevitable some slackness in business.

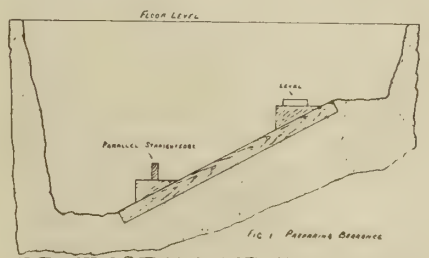
The Molding and Casting of Condenser Parts

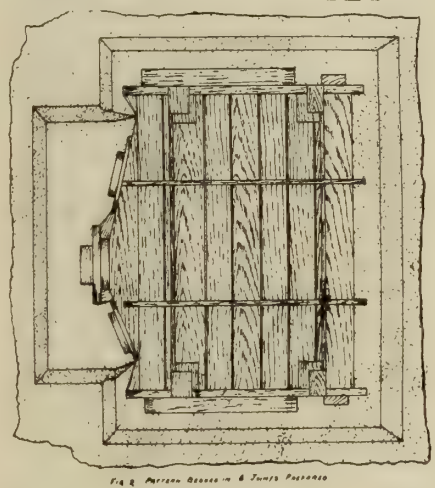
Showing Method of Molding the Patterns Described in Former Issues of This Publication, Being Condenser for Modern Steam-Ship Engine.

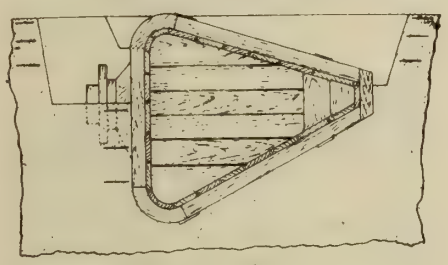
By BEN. SHAW and JAMES EDGAR

THE introduction of this type of condenser in marine work has been productive of quite a variety of means to ensure sound castings. The older type for triple or quadruple expansion engine usually carried the back columns for supporting the cylinders and supplying the crosshead guides, and the general form limited the molder in his choice, when deciding the method adopted in the construction of the mold. Casting on end being impracticable, it was necessary to prepare the mold for casting horizontally, and since the guides on the columns were required to be very sound, they were invariably cast down. The "round" condenser, another type so frequently used, though sometimes preferred riveted together, is often supplied in cast iron, and the comparatively simple nature of the cylindrical castings lends itself to being prepared and cast in a vertical direction. In the uniflux type, a greater variety of methods are at the disposal of the founder, providing the pattern work allows the necessary scope. When a new form of casting of such dimensions is required, it is necessary to have the opinion of the molder, as frequently much time and labor can be saved. The pattern construction can be varied to suit whatever available tackle the foundry may possess. Providing suitable boxes are in stock, the most profitable means of producing the main casting is to prepare the mold horizontally, adopting the roll-over process to consolidate the sand to regular density in the drag. It is rarely indeed however that jobbing foundries have such large boxes at hand for such work, and since it is rarely that quantities are required, the expense of preparing suitable molding types would be prohibitive. Some foundries have given considerable attention to the construction of molding boxes standardizing the sizes, so that they can be built up to accommodate a wider variety of work. The method is to be recommended, since many more sizes can be stocked, taking up very much less space than is required for the customary solid box. Stock bars, either single or double, are introduced to suit any given job when the box is assembled. The majority of foundries, however, reduce their expenditure on box parts by making use of the molding floor, and either sink large boxes or cases until



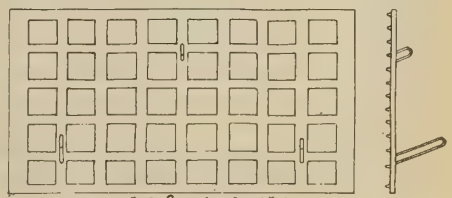






their top flanges are flush with the floor level or simply dig a pit to suit the work required. In each case the process of bedding in is resorted to, and necessitates the mold being prepared in its final position for receiving the metal. Other foundries make a specialty of loam molding for which a cheaper pattern will suffice. Not infrequently a skeleton pattern is supplied, from which the main core as well as the mold can be made. A considerable amount of tackle is required when the mold for such a casting as is under consideration is prepared in this manner, and as a rule its preparation occupies more time than when a dry sand mold is prepared, and the main core made separately. Generally speaking, the majority of foundries prepare such molds in dry sand and make use of a pit or case to take the work horizontally or vertically. When the former method is decided upon considerable care must be given to the bed upon which the pattern is set. The bottom of the mold being inaccessible for ramming when the pattern is in position, it is preferable to prepare a special bed upon which the main part of the pattern will rest. In this case it necessitates a bed being prepared at an angle with the floor level, and at a distance below it which will allow the ordinary type of solid cope box being used, which frequently means that the highest part of the pattern will be just about floor level.

Difficulty is sometimes experienced in dealing with a raking bearance and with a pattern other than rigid, the resulting casting may be twisted. It is not a difficult matter to prepare a level bearance, and if the same principle is adopted in setting the logs for a raking bearance there will be less possibility of it being winding. To set the logs accurately have pieces fixed to them temporarily, out to the rake necessary, so that when the logs are bedded in, the surface edges of these pieces will be parallel to the floor level. The method is illustrated in Fig. 1, whereby a spirit level is used on the top edge of the pieces, to set the logs with the requisite rake, and then they act as a support for a parallel straightedge which can be tested with the spirit level until the logs are out of winding with each other, when the bed can be rammed up and strickled off. This provides quite reliable bearance for the body of the pattern. When the logs are removed and the surface made up the pattern needs to be lowered to get an impression of the end flanges and the ribs. On the pattern being raised, the positions for these are loosened, some sand being removed and the pattern again lowered. This procedure usually gives a sufficiently definite impression of the projecting parts to allow the pieces being unscrewed from the pattern, then it is again lifted and made up in its respective position in the bed, the pattern being located by the end flanges when finally lowered. With the pattern set in position, the sand should be rammed up along the deep side to avoid any movement along the rake of the bearance. It is well to remember that when forming vertical sides of deep molds it is better



to strengthen the sand by means of rods set at intervals of about three or four inches and at right angles to the side of the pattern.

The first joint formed is that about the horizontal centre of the branch and it should be large enough to give a reasonable bearance for a drawback, which will take the impression of the upper

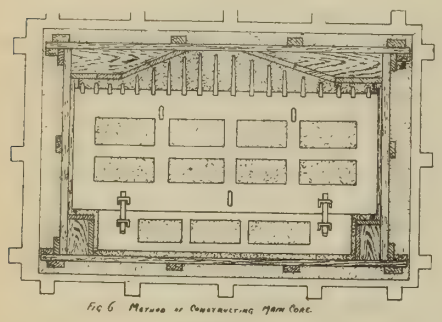


FIG 6 METHOD OF CONSTRUCTING MAIN CORE.

half of the branch. Once this joint has been defined, ramming can proceed and a joint formed off the highest part of the pattern and prints through which the whole pattern could be withdrawn. A plan showing the joint made up is shown in Fig. 2, a section through the centre of the mold being illustrated in Fig. 3. All joints should be given a good level bearance, and tapered well back to the floor level.

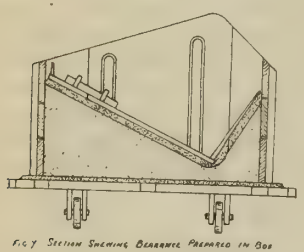


FIG 7 SECTION SHEWING BEARANCE PREPARED IN DRAG

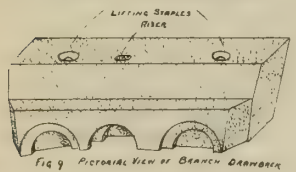


FIG 9 PICTORIAL VIEW OF BRANCH DRAWBACK

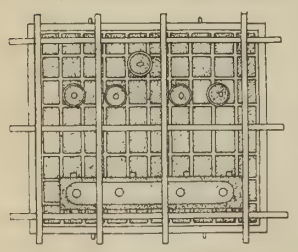


FIG 11 READY TO RECEIVE THE METAL

FIG 12

A plate is required to take the weight of the drawback over the branch when lifting. Such a one as is shown in Fig. 4 would answer the purpose satisfactorily, having a number of dabbers cast on the bottom and a couple of staples for lifting. It is good practice to bed this plate into a covering of loam when commencing to make up the drawback. Ram up to the floor level with sand, stiffening it over the branch by introducing a light semi-circular grid, and making up the joint to coincide with the top joint already formed. The joint indicated would necessitate a considerable lift if carried in the top box, the alternative is to prepare another drawback to reduce the amount of lift, and to give better facilities when closing the mold for casting. The whole of the cover need not be taken with this drawback, but only sufficient to render the top lift comparatively simple. Again the practice of giving a covering of loam can be resorted to, and the grid shown in Fig. 5 bedded into it. The dabbers in this case can be a bit longer to carry the depth of loam from the pattern body to the outside of the flanges and ribs. When this drawback is rammed up and a joint formed approximately in the position shown by the dotted line in Fig. 3, the cope box can be set in position, staked, and a commencement made on the cover. Either small grids, secured to the box or gaggers alone may be used to carry the sand forming the lift, and the whole rammed up. Probably the most convenient method of running such a job is by means of a spray along the narrow side of the condenser, risers being drawn from the highest points of the ribs and flanges, including the branch flange. This method has given satisfactory results, but whichever method is adopted must of necessity be provided for when preparing the drawbacks and cope. When the cover is completely rammed and the gate sticks withdrawn, it is necessary to dissemble it, in order to remove the pattern. Having examined the stakes to make sure that there will be no difficulty in locating the box accurately, it can be lifted and supported on standards for convenience in cleaning.

The cover drawbacks will then be lifted and supported temporarily. Providing the precaution has been taken to remove the screws, the section of pattern work such as the flanges, ribs and feet will be lifted in each case.

The branch drawback, when lifted, will carry the top half of the branch pattern and subsidiary portions from the main body. The boxed section of the pattern is then clear, and preparation is then made for its withdrawal. It is customary to introduce lifting plates during the construction of the pattern at convenient places. Either tapped plates for lifting screws, or those having rectangular holes through, suitable for tee lifting irons are required for this purpose and they should be secured on the bottom or very near it for patterns of this character, so that the framework will take the strain when lifting. All subsidiary parts will be left in the mold, only the boxed section being removed in the first place. When this has been accomplished the whole mold requires to be carefully sleeked up, the sand cut away to form fillets about the ribs and flanges and the small sections of pattern-work withdrawn. Parts of the mold forming fairly sharp corners of sand should be well nailed to give strength. The same procedure is adopted in connection with the drawbacks and cover. The runners require cutting and the whole generally cleaned up preparatory to drying. In work of this kind, which must be dried in place, the drawbacks can be returned, and the cover box supported over the mold so that whatever method of drying

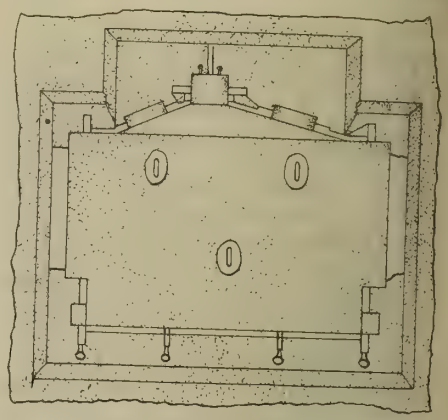


FIG 8 ASSEMBLING THE MOULD

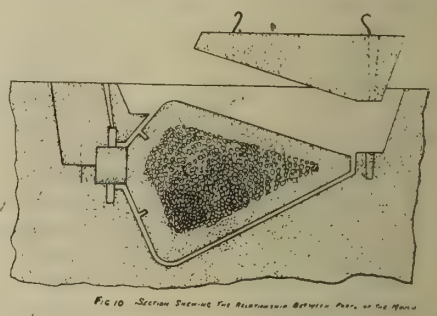


FIG 10 SECTION SHEWING THE RELATIONSHIP BETWEEN PARTS OF THE MOULD

is adopted can be safely used for all parts.

While the mold has been in progress the cores required will have been receiving attention, usually by another set of workmen. When the work can be so arranged, it is to be preferred, since castings can be produced more quickly, the object being to have both mold and cores ready for closing almost simultaneously.

The main core requires considerable preparation. A grid or plate is necessary, to give support to this core, and since the weight of it when completed is considerable, the strength of the plate must be such as will render lifting quite

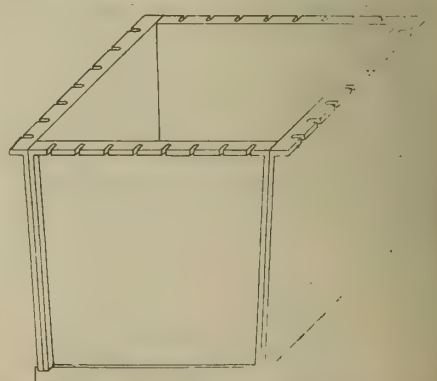
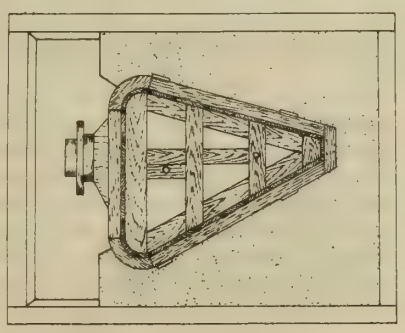


FIG. 13—CASE FOR BEDDING INTO FLOOR.

safe. Snugs can be carried on at each end of the plate to project beyond the ends of the core. This enables the molder to give additional support to the core when closing, relieving the pressure on the prints. Such a method, however, necessitates cutting the core box, and since it can be avoided in this instance, without detriment to the resulting casting, the method is not illustrated in the sketches. A suitable type of plate for this core is shown in Fig. 6. It is made in two parts, which are secured by means of a wedged bar passed through staples. Those bars can be conveniently removed, and the plates drawn out singly when the casting is being cleaned. Cores of this description are usually made on a special core floor adjoining a large core oven, and to facilitate the transfer of the core to the oven it is frequently made upon a bogie plate as shown in Fig. 7. A loam bearance, usually dried, is prepared for setting the core box level. Owing to the particular shape of the required core, it is necessary to strickle up a bearance after the core box is set on the bogie, and for this purpose the loose parts inside the box are removed temporarily, leaving the guide pieces for shaping the bearance or cup for the core. The major part is made up with bricks, and these are surfaced with ordinary floor sand, being strickled off to coincide with the guides attached to each end of the box. When this has been prepared the construction of the core can proceed. The bearance is given a good thickness of loam into which the clay-washed plate is bedded. Bricks and loam can be used to form the shape, but if long prods or gaggers project from the outside of the plate and follow the contour of the core required, the bricks can be discarded, and loam merely used to form an outside shell, introducing hard loam to stiffen the whole. Fairly larger sized ashes require to be well rammed into the centre of the core, and the top made up to a depth of about 5 inches or 6 inches with loam. It is the usual custom to leave the loam above the shape determined by the corebox, until the whole becomes stiffened, when it is strickled off to the core box ends. Fig. 6 gives a general plan of the core box set on the bogie plate, the bottom shape of the core having been made up and the core plate bedded into its position, the loose parts of the core box having been returned to their respective positions. A section through the branch connection is illustrated in Fig. 7. When this core has been strickled off clearance is cut about the top of the lifting staples, and a commencement made to remove the woodwork. Providing the loam is stiff enough, all the various parts of the core box can be stripped from the core. The whole weight is taken by the shaped bearance upon which it is dried. During the process of stripping, the core should be sleeked over and corners rounded off where necessary. The smaller cores including those for the foot branch manholes, and the two loose cores necessary for each end of the condenser are also prepared and transferred to the stove for drying.

When both mold and cores are dry all parts with which the molten metal comes into contact are washed with blacking to prevent the metal fusing with the sand and give a good skin to the casting. Considerable skill is required in the process to prevent the blacking peeling when sleeking over. Special attention is given to the runners and risers and the whole job thoroughly dried again. It is necessary to prepare runner and riser basins, in order that they will be in readiness when the mold is fitted together finally.

The most convenient form of runner is one which will feed all the gates together, and since the metal is comparatively thin and covering a fairly large surface, it is preferable to prepare this runner so that stoppers can be used to prevent the mold obtaining metal until the runner is full. The riser basins can be separate, ordinary circular boxes being used. In both cases these should be



prepared and dried, and then washed with blacking, but not infrequently they are black washed directly they are made, and then dried, a good surface not being quite so important as with the mold.

When all the parts are thoroughly dried the operation of coring up can be carried on. The small cores lightening out the back of the feet in the bottom are first located and then secured with nails to prevent movement, and as these cores do not cut through, as a precaution against lifting a double chaplet should be nailed to each core. The manhole core in the bottom is more easily secured to the mold, and it should project just the thickness of metal. To ensure accuracy it should be tested. The main core can now be lowered into position, the ends of which should be free to the ashes, and the mold eased away at the large prints for more ashes, to enable the gases generated when casting to escape easily. When this core is in its relative position, the branch core can be set in. If this core is a neat fit no other support need be given to it, other than that which is supplied by the print. A contact can be made between the branch core and the vent of the main core. The other cores which can be set from the joint, and indicated in the plan view Fig. 8, need no special fastening, but the small cores for the top feet required to be wired through the drawback, so that their position will be maintained in an inverted position. It is necessary to make up the main core about the lifting staples, and care should be taken to insure the sand being dried. Both drawbacks, one of which is illustrated in Fig. 9, can now be set, the runners tested to make sure they are clear, and then the cover box lowered. A section of the mold during the process of closing is shown in Fig. 10.

When the job is closed the runner and riser basins require to be grouted into position, and the whole box weighted down preparatory to casting the metal. A general view of the method adopted is shown in Fig. 11. When a cast iron case is used for bedding in such a job additional means are adopted to restrain the lift of the cover box when casting by clamping the joint flanges or better still when the flanges have a series of equidistant slots, they can be bolted. The form of stopper used to cover the gates during the time of filling up the runner is shown in Fig. 12.

While the general form of the condenser lends itself to being cast in the manner indicated, many foundries prefer casting them vertically, and this preference is more in evidence in those foundries having what might be termed special cylinder cases, bedded into the foundry floor. The greatest difficulty experienced is in the formation of the main core, since it cannot be conveniently made on its side and then turned up on end, and it is rather a risky undertaking to make it on end in the ordinary way, that is on a bogie, as previously explained. It can, however, be made nearer the foundry floor with a different form of core box, and having a full bottom plate introduced by which the core, built up in the same manner as a cylindrical core, can be lifted after the loam has stiffened sufficiently.

(Continued in Next Issue)

GOOD WORK OF RECIPROCATOR

The splendid performance of the S.S. Kandahar owned by Ellerman & Bucknell has recently attracted considerable attention.

This vessel is of 10,750 D.W. tonnage, equipped with triple expansion, engines, H.P. 25½ inches, M.P. 43½ iches, L.P. 76 inches, stroke 51 inches, developing 3,200 I.H.P. at a speed of 12 knots. It is fitted with three single end Scotch boilers with Howden forced draft, and with fire tube superheaters delivering 200 deg. at the main engine throttle. She burns about 42½ tons of coal per 24 hours or about 1.24 pounds of coal per I.H.P. for all purposes.

This vessel has been operating since 1913.

MARINE NEWS FROM EVERY SOURCE

TORONTO.—The work of completing the two ships on the stocks of the Dominion Shipbuilding & Repairing Co. has been awarded to the Collingwood Shipbuilding Co., who will proceed with the work during the winter. The work was given out by the Government at this time chiefly to relieve the unemployment situation, and it is expected that it will give employment to about 1,000 men for several months.

Kingston.—The steamer "Schoolcraft" bound from Kingston for Montreal was completely destroyed by fire early in the month. Fire broke out so suddenly and made such rapid headway that the men were forced to take to the boats, losing all their belongings. They all got away safely but one, who was seriously injured. The skipper kept the wheel until he had beached the vessel on Wolfe Island, but the fire had got such headway that it was impossible to do anything towards saving her.

Chicago.—Navigation of the Great Lakes will be made safer in the near future by the erection of a chain of automatic wireless stations, which will be undertaken by the United States Government. Ships approaching dangerous reefs, will be warned by automatic messages sent out at a pitch that can be picked up by the wireless of any vessel. There will be ten of these stations altogether, and they will cost about $15,000 each.

Halifax.—The master of the Norwegian steamer "Romsdalsford," recently wrecked off the harbor of Halifax, testified that he mistook the light on Sambro Island for that on Chebucto Head, and as he did not see the Halifax Lightship thought he was safe in the course he was steering. He had had no notice that the Halifax Lightship was not on her station. The charts on the vessel, as far as the United States were concerned, were the latest, but the Halifax charts were five years old. He was bound for Narvik from Baltimore, and went into Halifax for bunkers.

St. John, Nfld.—Three vessels belonging to the Newfoundland fishing fleet have been lost, two of them foundering at sea, and one being lost by stranding. The "Ludwig" was lost off the coast of Spain, her captain being drowned. The "Belliveau," bound home from Spain, foundered in mid-ocean, all the crew being saved. The schooner "Harriet" went ashore on the north coast of Newfoundland and is a total wreck.

London. — The steamer "Montrose" was launched at Govan on the Clyde about the middle of December, being the second of the three new ships being built for Canadian Pacific Ocean Services. The first one, the "Montcalm," was launched some time ago. When the third is completed the company will have fifteen vessels in the service on the North Atlantic. The new vessel is 16,000 tons.

Amherstburg.—Captain Ingersoll, for nine years in charge of Bar Point Shoal Lightship, has been pensioned by the United States Lighthouse Bureau. The captain was 70 years old this month, and had been a sailor all his life. He had not confined his wanderings to the lakes, but had sailed all over the world. He plans to end his days in Amherstburg and Detroit.

Kingston.—The wireless telephone is to be installed on Duck Island before next season's navigation opens and will be erected by C. W. Cole, of Cape Vincent, who owns the island. The adjacent waters are very dangerous for ships, and on the stranding of the "Randall" recently the crew were unable to get into communication with the mainland for nine days. The wireless telephone will relieve any such necessity in the future.

Montreal.—It is stated here that in future there will be no more enquiries held into marine casualties in Canadian waters, unless it is specially requested by the owners or agents of the vessels concerned.

Detroit.—The tug Sport was lost about three miles off Lexington in a heavy gale which blew over Lake Superior recently. The tug was bound for Harbor Beach when she was caught by the storm, and the captain turned her round and ran for Port Huron. She shipped such heavy water that the fires were eventually put out and the vessel filled. When the water reached the rail the crew took to the boat and reached shore safely.

Washington.—As a result of the trials of the cargo vessel "Eclipse" by the United States Shipping Board it has been decided to apply the same means of propulsion, that is the turbo electric drive, to ten other large cargo vessels. The General Electric Company of America has received the contract for the machinery of the steamers.

Kingston.—In connection with the foundering of the steamer Randall recently near Duck Island, when the captain and crew had to swim ashore, and then walk five miles to a lighthouse, complaint was made by them about the life belts supplied the vessel. These were of the type that have to be fastened round the neck, and the men said that they were almost strangled while swimming in them. Incidentally the men were imprisoned for ten days before communication could be made with the mainland.

Halifax.—The steamer "Paipoonge," bound from Quebec to New York, arrived in Halifax with a tale of hard luck. She ran into a gale shortly after leaving Quebec, and her derricks got adrift and the standard compass smashed. During the height of the gale the galley somehow caught fire, and was only extinguished after much hard work.

Windsor.—Capt. Jacques LaFramboise, aged 80, one of the few remaining old-time Great Lakes mariners, died at his home in Amherstburg. For more than half a century he sailed the lakes, retiring ten years ago. Capt. LaFramboise was a native son of Essex County, having been born on the banks of the River Canard. He started as a deck hand on a sailing schooner carrying wood from Amherstburg to Detroit, and later became known as an expert sailboat navigator.

Toronto.—Liquidation of the Dominion Shipbuilding & Repair Co. has been delayed by doubt as to what is to be done with two boats which are under construction for the Government. It is probable that another firm of contractors will be asked to complete them in the yards of the defunct company. In the meantime negotiations for the disposal of the property are being held up.

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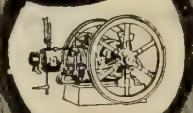
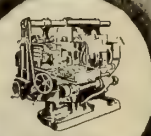
VALVES AND STEAM GOODS


OIL ENGINES

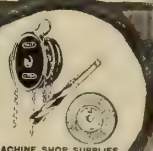

MACHINE TOOLS

PULP AND PAPER MACHINERY

TRANSMISSION

RAILWAYS SUPPLIES

CONTRACTORS' EQUIPMENT

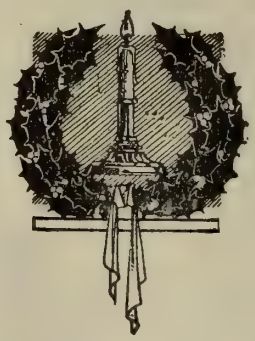

MACHINE SHOP SUPPLIES

SCALES

DYNAMOS AND SUPPLIES

PUMPS

AUTOMOTIVE EQUIPMENT



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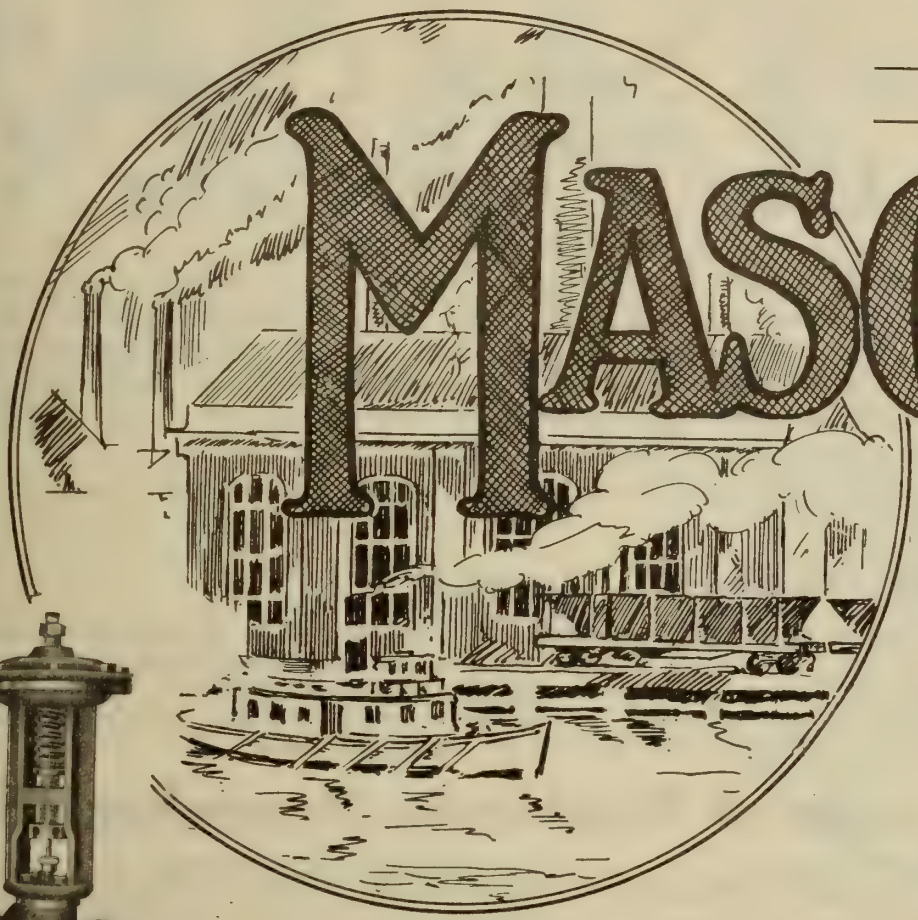

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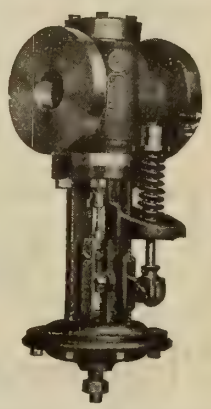
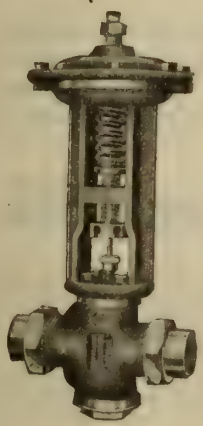


Mason No. 126 Style Marine Reducing Valve



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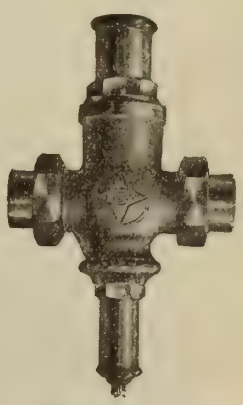
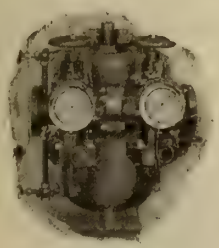


Mason Standard Bronze Reducing Valve



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What Will Santa Claus Bring Our Politicians ?

"SANTA'S POLITICAL STOCKING" is the title of J. K. Munro's feature article in MACLEAN'S December 15th issue. Mr. Munro thinks old Kris Kringle should bring Premier Meighen a "cap that will pull down over his ears, so that he can't hear what his Cabinet colleagues are saying about him"; a hobby horse for Crerar; a tin sword for Ballantyne; a "white plume" for Lapointe; a case of grape juice for Rowell, and a pair of long trousers for Mackenzie King.

Mr. Munro also sizes up the East Elgin farmers' victory, and lets you know its real significance.

Dr. Wilfred T. Grenfell, C.M.G.

THE famous physician of Labrador has contributed a striking piece of graphic fact-fiction for the Christmas issue—"Deeds of 'Derring Do'," which describes the brave fight waged by Skipper Lovedav, his crew and wife—in the dismantled Silver Queen. They expected to find a watery grave that Christmas week, but the wife's dauntless spirit put so much courage into the men that they won a fearful fight against the December gales.

Christmas Issue of Maclean's, December 15th

"THE EMANCIPATION OF POLLY MacCRAE"
By F. B. M. Collier.
The so-human story of two spinster sisters in Old Ontario and how the crippled one won a husband.

"THE JEST OF CIRCUMSTANCE"
By Gertrude Arnold.
Phyllis lands in a Canadian city, fresh from England, and there is no fiancé to meet her. The girl ultimately finds happiness just as the Christmas Carols commence—but how?

"OUR GOLDEN FLOOD ROARS EAST"
By Nicholas North.
Every few minutes a train loads up at one of our many mammoth grain elevators, taking our wheat to the seaboard.

"THE CITY OF PERIL"
By Arthur Stringer.
The largest instalment yet published of this sensational dramatic serial of Bolshevistic plotting in New York.

"—AND ALL POINTS NORTH."
By Nellie L. McClung.
A gripping story of the pioneer men and women of the Peace River country—many even out of the reach of railroads, telephones and doctors. Read what trained nurses are doing in the pioneer settlements.

"OF CHRISTMASES AND GOVERNORS"
By Colonel George Ham.
The "Colonel" has spent Christmas in some peculiar places. His experiences form the foundation of a great story. Also, Col. Ham tells of the human side of some of our Governors-General.

"WHO GETS OUR PAPER PROFITS?"
By Agnes C. Laut.
The real facts of our paper, pulp and sulphite products, and some information as to where the biggest slices of the melon go.

"THE YULETIDE GLOW"
By Charles Christopher Jenkins.
What converts Scrooges into human beings, 'round about December each year? Get in a crowd with "Jenk" and you'll find out.

"BUTTERED SIDE UP"
By C. W. Stephens.
The hero of this story loses his job a few days before Christmas. But he doesn't lose the girl, and lands a real job Christmas Eve.

"ORATORS I HAVE ENJOYED"
By "Margot" Asquith.
The wife of the ex-Premier tells what she thinks of Lloyd-George, as an orator, and others.

Review of Reviews Section

"The War Spirit in the World"—By Sisley Huddleston.
"The Irresistible Thing"—By Sir Gilbert Parker.
"German Universities Hard Up"—By Allen W. Porterfield.
"The Bleeding Statues of Tipperary"—By Edwin E. Slosson.
"A Modern Burton"—By Charles A. Merrill.
"Lansdowne's Memories"—By Marquis of Lansdowne, K.G.
"Flesh and Blood Inspired Barrie"—By William de Wagstaffe.
"Doctors Dupes of Fashion?"—London Lancet.

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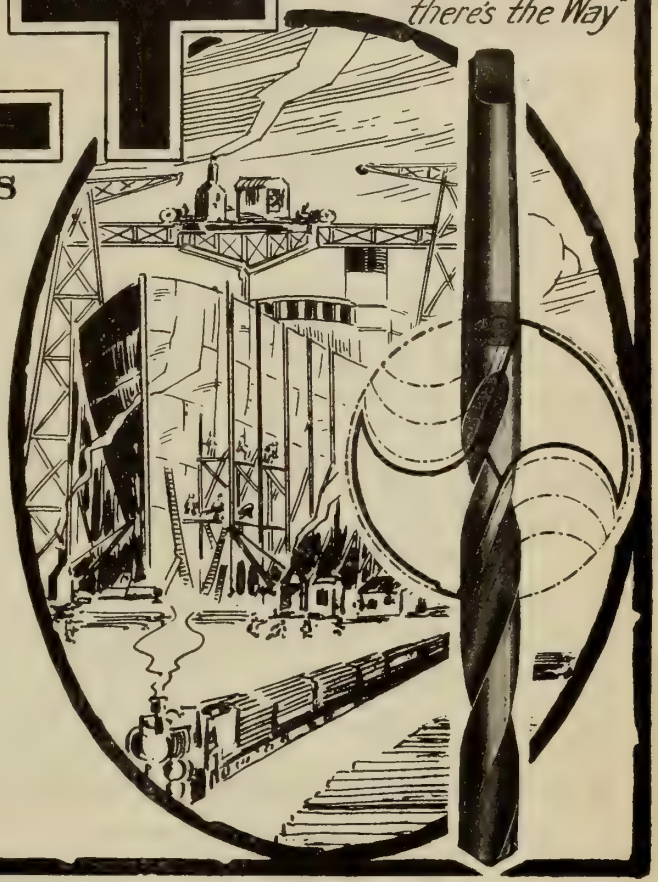

The Wilt Twist Drill Company of Canada, Ltd., wishes to extend to its many friends a Very Merry Christmas and a Happy and Prosperous New Year.

We take this opportunity of extending thanks for the business we have been favored with during the present year and are happy in the thought that the quality, price and service we are rendering will merit a repetition of these numerous favors.

It is our sincere hope that the New Year will bring relief from the trials and tribulations which inevitably follow such a world-wide upheaval.

May the New Year favor us with a quick return to normal conditions.

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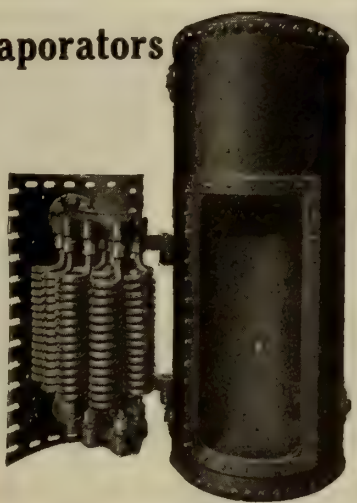

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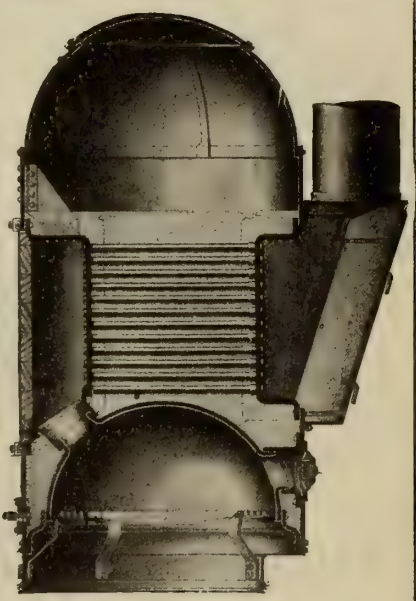

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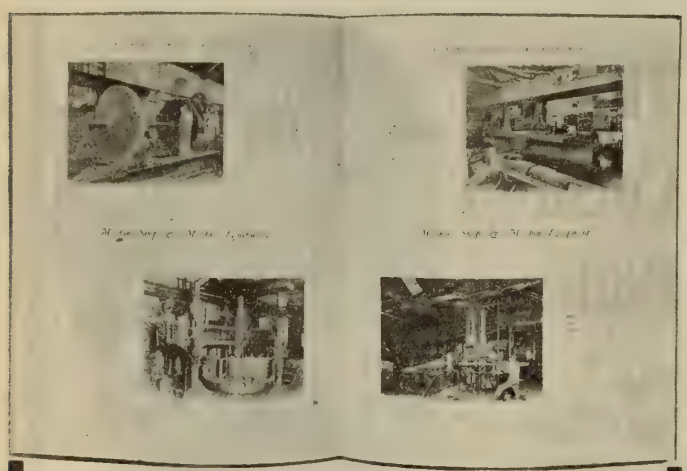

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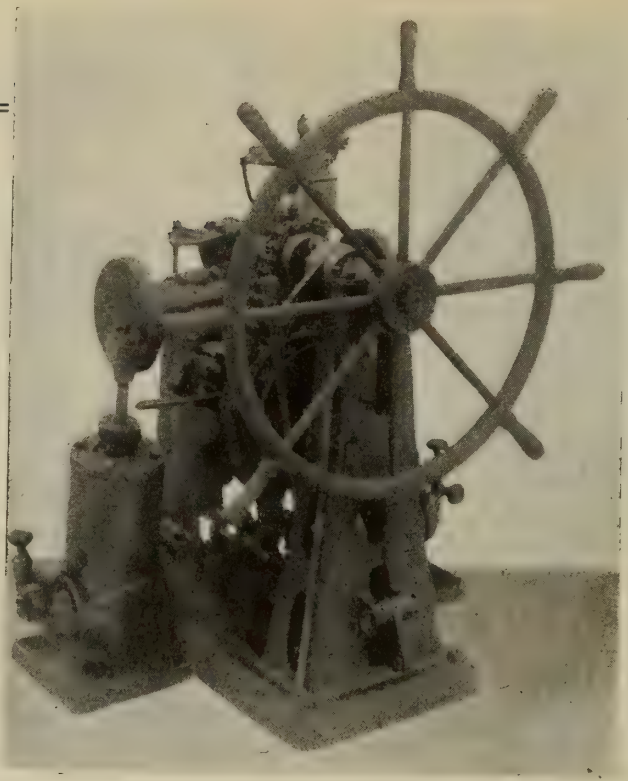

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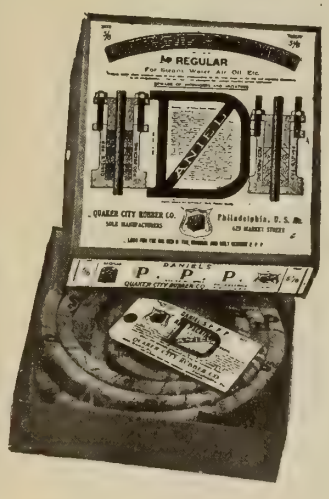

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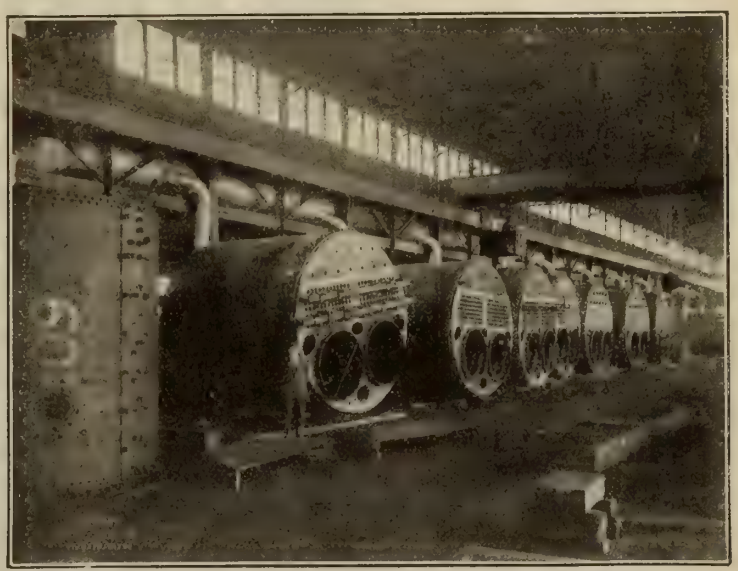

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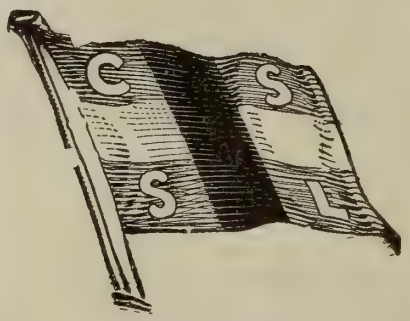

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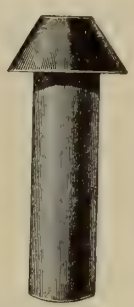

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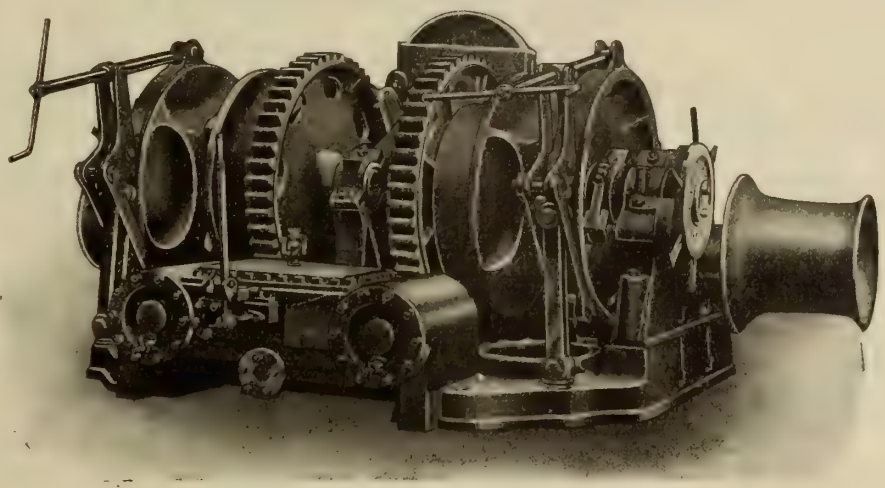

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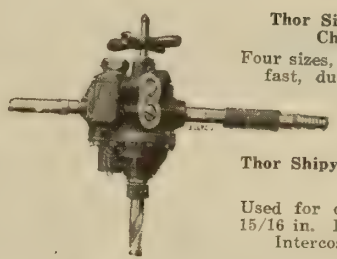

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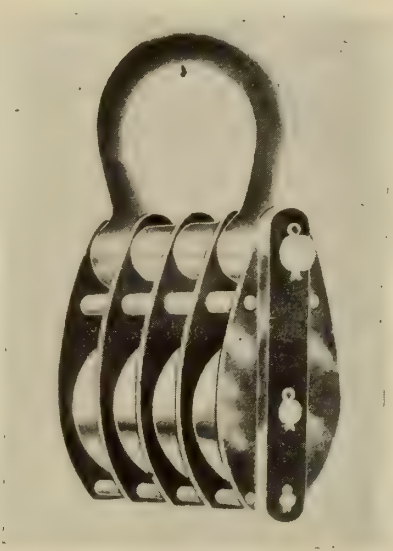

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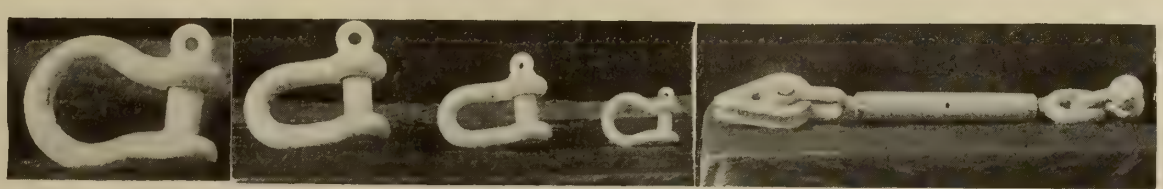

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DRILLS, ROCK
Samuel Osborn Co.

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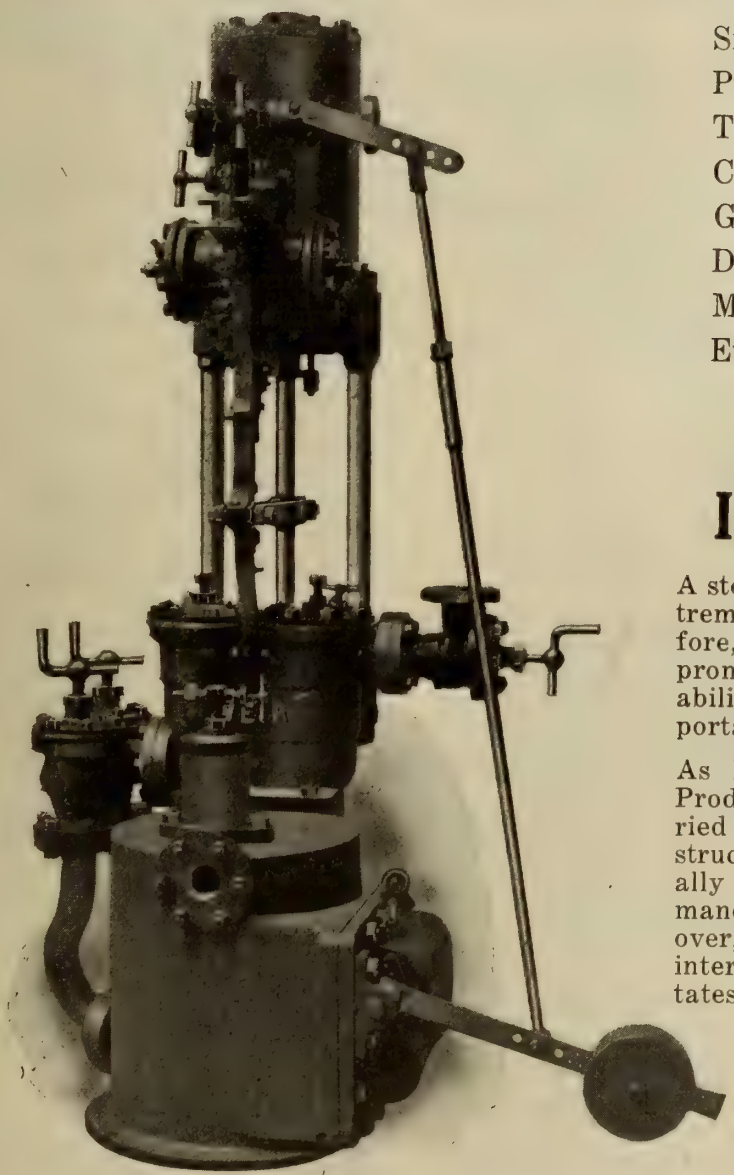

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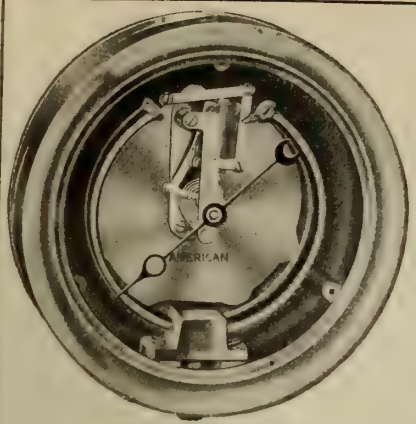

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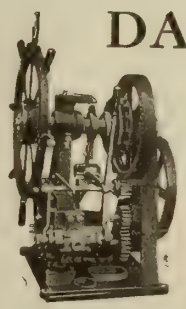

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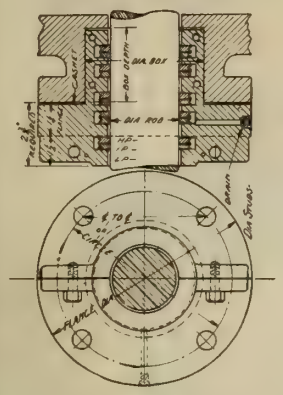

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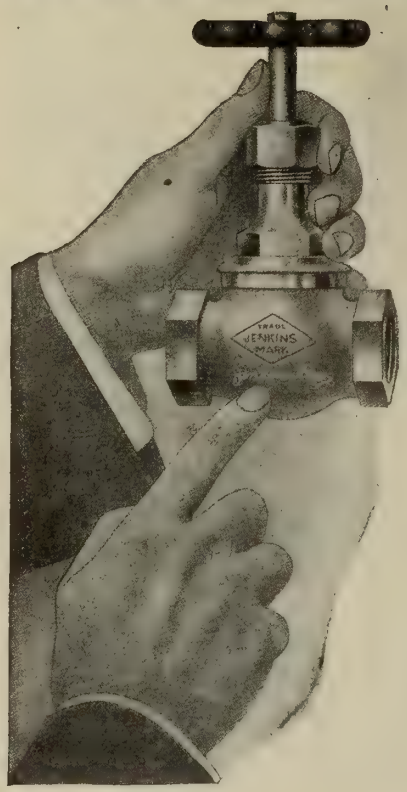

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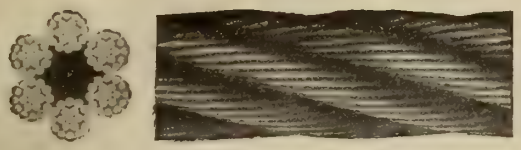

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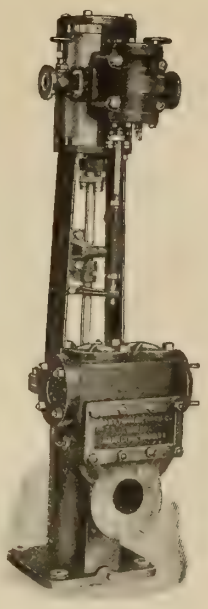

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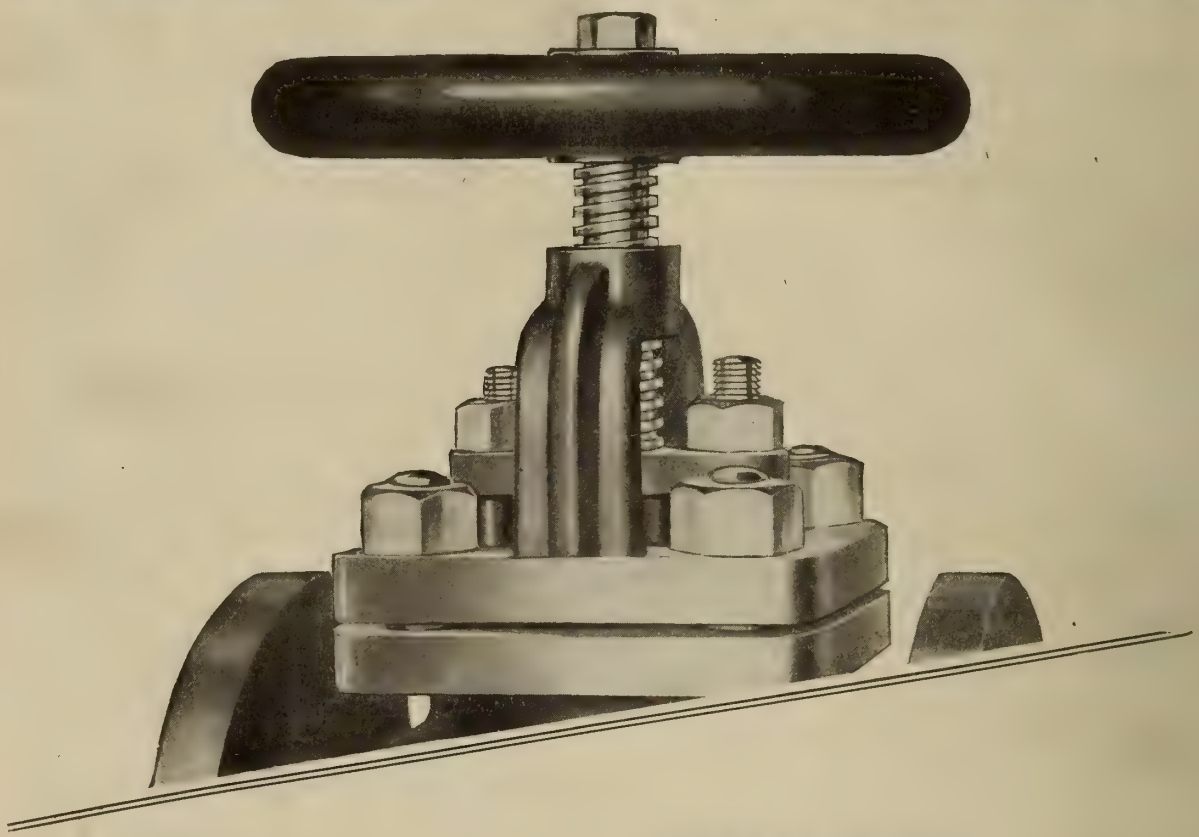

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